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Development and use of visual materials for training food service employees in work simplification

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**DEVELOPMENT AND USE OF VISUAL MATERIALS
FOR TRAINING FOOD SERVICE EMPLOYEES IN WORK SIMPLIFICATION**

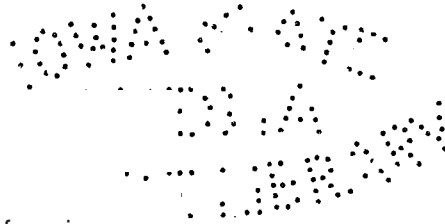
by

Marjorie Marie McKinley

**A Dissertation Submitted to the
Graduate Faculty in Partial Fulfillment of
The Requirements for the Degree of
DOCTOR OF PHILOSOPHY**

**Major Subjects: Institution Management
Home Economics Education**

Approved:



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Dean of Graduate College

Iowa State College

1956

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INTRODUCTION

Since the latter part of the nineteenth century a concerted effort has been made to adopt a scientific approach to problems of management. The guiding objective has been a more efficient and effective use of all resources including men, money, materials, and machines. The outcome has been increased productivity and a higher level of material well-being. The early emphasis was on technological developments, but gradually as the science and art of management have developed, increased attention has been given to problems concerned with human relations.

At the present time management faces many problems. One of the paramount concerns is to find ways in which labor, both as individuals and groups, and management can work together effectively. Another concern is to find means to meet the spiral of increased costs and combat the resulting inflationary effects. It is believed by many that the most promising solution to this latter problem is increased production efficiency.

Since the present research enfolds the food service industry, methods improvement, and work simplification training for workers, various aspects regarding these areas are presented before defining the purposes of the present research.

The Food Service Industry

The food service industry has been slow to adopt the scientific approach being increasingly utilized in many other areas. The possible

explanations for this fact are numerous. It is well to review the place of this industry in our total industrial picture and some of the characteristics of the industry which influence the extent to which a more scientific approach toward problems of management is adopted.

According to data based on the 1954 census of business (48, 64), the food service industry is the fourth largest business in terms of dollar volume of personal consumption expenditures. Excluding the food produced and consumed on farms, which does not enter into commercial trade, about 25 per cent of the value of food consumed in the United States passes through food service establishments. In the more than half a million food service units, an average of 75 million meals are served daily. Of the total number of establishments, about 10 per cent do nearly 80 per cent of the total volume of business. The food service industry ranks first among retail trades in the number of people employed.

The volume of business by the food service industry during the period from 1930 through 1950 increased from over three billion dollars to seventeen billion (48). It is expected that there will be a continual rise in the volume of business as current trends increase the need for group food service and as the demand for ready prepared "take home" meals grows.

Many of the food service units are extremely small, represent a very limited capital outlay, and are managed by individuals who have little training or experience in methods of management. As stated above, however, most of the total volume of business is done in a relatively small proportion of the food service establishments. This distribution

of establishments is not peculiar to the food service industry, for according to 1947 figures, although 80 per cent of all manufacturing establishments employed less than 50 workers, one third of all wage earners in manufacturing were in plants employing 1000 or more workers, and over one fourth were in plants employing from 250 to 999 workers (46).

A food service unit usually performs both a production and a service function. Although centralized mass production of some food items is possible, and a trend in this direction is evident, it is at present generally agreed that there are many advantages to having food production close to food service, both from the standpoint of distance and time.

There are a variety of problems which must be met. Most of the ingredients and the final products being produced are perishable. Standardization of the quality of the final product is a desired objective; nevertheless, variation of quality of ingredients must often be accepted even though an attempt is made by use of specifications to standardize the quality of food purchased. In addition in many situations, particularly in units that serve the same clientele repeatedly, a variety of menu items among meals is considered desirable.

Food service is for the most part a nonrepetitive industry as contrasted to a repetitive-process industry in which highly standardized products are built in repetitive lots by mass production techniques (2, 17). Furthermore, the planning and scheduling of a food service operation must usually be geared to meal service during three distinct periods of the day. The volume of activities and the resulting demand for labor fluctuate greatly corresponding to the periods of service. Frequently the over-all time of operation per day extends over a fourteen hour\

period, and a seven-day week operation is common in some types of food service.

The many variables which exist within the industry, and the decentralization of operations have undoubtedly contributed to the rule-of-thumb approach to food service management that has been retained tenaciously. Possibly a more important contributing factor has been the attitude toward food preparation and service. There is a tendency for each person to consider himself a connoisseur of food, and a great majority of people have had some experience in preparing food. Perhaps for these reasons, an awareness has been slow to develop that quantity food production and service must be founded on a scientific approach if it is to contribute to the physical and social well-being of groups and still function on an economically sound basis.

Although the food service industry has been slow to apply scientific principles to food preparation, to mechanize operations, and in general to adopt a scientific basis in managing resources, notable advances have been made. Many leaders in all types of food service have pioneered in developing better procedures and in raising the standards of food service. Advances have been achieved in improving the equipment and other physical facilities. Better food preparation techniques have been developed. It would appear that owing to the efforts of individual leaders and trade and professional groups, that the industry is making a concerted effort to improve the efficiency and effectiveness of its operations.

Within the last ten years, particularly, members of management in the food service industry have evidenced an awareness of the need for improving job methods as a basis for producing food of the desired quality and

operating at an economical level of efficiency. Likewise, as in other industries, there has been considerable attention given to ways of providing for the development of labor potential and for the most effective utilization of the possible contribution of individuals to the total work product.

Methods Improvement

Increased efficiency in industry has come about largely as a result of methods improvement. Much of the credit for the development of improved methods may be given to the work of methods and industrial engineers. The fundamental philosophy on which their work has progressed is based on two assumptions (44, p. 21-22):

1. There are usually numerous ways to perform any task, but with the knowledge obtainable at any one time, one method is usually superior to the others.
2. The scientific method of solving problems is more productive of better work methods than is undisciplined ingenuity.

According to Mundel (44), the general procedure followed to determine the preferred way of doing a job is the same regardless of the type of job, whether it be in light or heavy industry, on the farm, in a hospital, or any other type of production unit.

No gain can be realized from improved methods, however, unless the method is actually installed and continually used by the workers. Frequently workers have refused to use improved methods that have been developed. Resistance to change is well documented in the industrial literature, and management as well as labor often resist new methods.

Methods changes may appear to those performing, directing, and supervising work to be a criticism of their efforts (44).

It has been recognized that in order for the motion and time study departments in industry, which frequently carry the chief responsibility for methods development, to function effectively "supervisors at all levels must be educationally equipped to cooperate intelligently in the motion and time study approach, even to the extent of actually applying motion and time study as a normal part of their activity" (44, p. 19). The top executives too must acquire an understanding of the basic concepts, for the attitude of top management toward change and the procedures used to bring about change is one of the important factors affecting the success of a methods improvement program.

Some successful attempts have also been made to include the workers in programs of methods improvement training. There is evidence to indicate that workers will more readily accept and use prescribed methods if they understand why the work should be done in a particular way or if they have developed or have helped to develop the improved methods. Further, it has frequently been proposed that workers derive greater satisfaction from their work if they have an opportunity to contribute to decisions which affect their jobs. In addition, experience has shown that workers who are actually doing a job can make valuable suggestions for improvements, if guided and encouraged to do so. In view of these considerations, recommendations have been made that work simplification training be provided for workers doing the jobs as well as for supervisors and top management.

Even though the advantages of a cooperative approach toward the

development and installation of improved methods appear evident, it must be recognized that final decisions concerning the methods used by a worker are in most situations a responsibility of management. This is a necessary condition since methods are critical to the total outcomes, and factors outside of a given work situation may dictate the need for a particular method. Management controls the organization of the total work process; the quantity, quality, and design of the finished product; the materials and ingredients used in the product; and the equipment and other facilities available. All of these factors affect the decisions in regard to work methods. The primary objective of work simplification training for workers is not to develop skill in improving methods, but rather to help provide an understanding and develop attitudes which will facilitate the process of methods improvement.

The extent to which workers may determine their individual methods of work varies according to the type of industry. In repetitive work, methods are usually standardized and are not subject to modification at the workers' discretion. In nonrepetitive industry, owing to the great variability of work, standardization of all methods is neither possible nor practical. For greatest effectiveness of operation in quantity food production and service, management should standardize the methods used for all major or key processes, because standardization is a means of control; but there are, nevertheless, many situations in which workers may determine their own methods.

Work Simplification Training for Employees

The objective of work simplification is methods improvement, that is,

finding a better way. According to Alford (2), work simplification includes process analysis, simple motion study, and micromotion study, and these represent in sequence the degree of refinement in the analysis of any given work cycle. It would be wasteful, for example, to attempt a micromotion analysis before a decision was reached on the need for doing an operation, or the desirability of a particular sequence.

Training workers is one of the important responsibilities of management, and it is generally agreed that the results of effective training may be advantageous to the workers as well as to management. How to train workers effectively for their jobs is a question of primary concern. Much of the training must be done on the job. Some aspects may, however, be done more economically and more effectively by group training meetings or classes. Sanitation and safety are frequently taught in this manner. There has been an increase in the prevalence of short courses and series of classes for training food production and service workers in all phases of their work. For small food service units, group training may be the appropriate method when a consultant, part-time (shared) dietitian, or area supervisor are employed to train the food service workers.

Employee training is essentially a process of teaching; therefore, to be effective, training should be based on valid principles of learning. It is believed that the effectiveness of training can often be improved by the use of visual materials, for the visual materials assist the process of communication between the trainer and trainee. There is a need for development of methods and visual materials for teaching work simplification to food production and service employees. Methods and materials,

evolved for use in teaching work simplification in some other areas, have not been developed to any extent for application in the food service industry. The anticipated results of teaching food service workers to apply principles of work simplification justifies the development of methods and visual materials directly related to this area of work.

Objectives of work simplification training for employees¹

On the basis of the work simplification programs that have been conducted which included work simplification training for workers, the following objectives for such training for workers were developed:

1. To provide an understanding of work simplification which will make the workers receptive to analysis of their jobs, to methods proposed by management, and to adoption and use of the methods prescribed
2. To improve management-labor relations and increase the interest of employees in their work
3. To stimulate employees to make suggestions for improving work methods
4. To assist the workers to improve those methods of work which are determined by them
5. To lower costs
6. To give impetus to a continuing program of work simplification.

¹The term employees is used here to mean workers below the level of supervisors.

The Present Research Problem

Many factors influenced the decisions in regard to the selection of this research problem. One was the belief that if palatable and nutritious food, prepared and served in a sanitary and otherwise acceptable manner, is the objective of the dietetic profession and the food service industry, then efficient and effective management of all the resources involved in large group food services is essential. Even though a food service operation is not a profit making endeavor, as is the case in many hospitals, schools, and public institutions, economically sound management is necessary. Through the application of principles of management, the sciences of foods and nutrition can be effectively applied to group food service (8). It was likewise recognized that successful group food service offers one of the best opportunities for promoting better food habits (9).

One of the chief determinents in the definition of the problem was the conviction that the personnel of an organization is one of the most decisive constituents contributing to the accomplishment of its objectives. Another factor was the belief that by application of valid principles of learning, the possible potential contribution of workers to the organization can be more nearly realized. In addition, there seemed to be unlimited opportunity and certainly a great need in the food service industry to simplify and improve the methods used to accomplish the necessary work.

Purposes of the present research

The present research is exploratory in nature. The purposes are:

1. To select appropriate available visual materials and to develop additional visual materials for training food service employees in work simplification
2. To plan and try out work simplification training for a group of food service employees using the visual materials selected and developed
3. To secure information relative to the outcomes of the training program in order to formulate hypotheses regarding the training of employees and specifically in regard to the use of visual materials for teaching principles of work simplification
4. To provide a basis for recommending methods of research for similar studies.

One problem encountered in research is that the methods necessary to collect evidence may alter or affect the situations or phenomena being studied. This is especially a problem in social science research. Management research, in which human participation is an important part, presents not only many existing variables, but the research techniques applied to evaluate various methods may substantially influence the outcomes. It is difficult, for example, to measure the effects of training methods per se. Employees' performance or attitudes may improve simply as a result of attention given to the group, rather than from any

specific procedure followed or change made. This situation was indicated in the Hawthorne studies (59). It is likewise difficult to determine the long term effects of training because of the many intervening factors which may influence the results. It is apparent, therefore, that one of the needs is development of research methodology, and it was one of the purposes of the present research to provide a basis for some recommendations in this regard.

REVIEW OF LITERATURE

Investigation was made of the literature relative to training of workers and work simplification. Each of these subjects is broad in scope, however, and the reports on each topic are necessarily delimited. Areas reported related to training include: scope of and need for training; responsibility for training; audio-visual materials; and training the adult worker. In the reviews related to work simplification, examples of work simplification programs are given and related research studies reported.

Training

Although the literature about training is extensive, relatively little data based on research investigations of industrial training are available. McGehee stated in reference to many of the proposals regarding training that "at the best they leave many recognized uncontrolled variables and, at the worst, will perpetuate the post hoc fallacy" (30, p. 110). As an example McGehee cited the final report on the Training Within Industry program in which outcomes of the program were claimed without any indication of other contributing factors. McGehee explained the problems of evaluating training as follows (30, p. 111-112):

The failure to make adequate evaluation of training techniques and methods arises from two sources. First, training personnel, by and in large, are not acquainted with the exact methods of controlled research and statistical techniques. Second, and

perhaps even more important, industrial executives have not been indoctrinated into the necessity of careful evaluation of training as well as other personnel activities. A new material, product, or machine can be tested usually in a laboratory without undue disruption of the flow of work. To evaluate training by controlled research often involves departing from work routines.

. . . . We recently were asked to help improve training procedures in a certain operation and took the following steps: improved initial selection of trainees; revised the training syllabus; made some slight changes in the method of operation; inserted rest pauses during the training hours; provided for progress charts; and arranged for periodic interviews between trainees, instructors, and supervisors. We have clear-cut evidence that we reduced training time, yet we do not know to which of these innovations or to what combination to attribute this improvement. . . . From the standpoint of management we had achieved what was necessary. However, we gained no insights for future use on similar problems as to the effectiveness of the specific steps which we took.

Using abstracts that appeared in Psychological Abstracts, McGehee (30) compared the literature on industrial training between the years 1934 to 1938 with that from 1944 to 1948. The literature indicated an increased interest by psychologists in industrial training during the latter period. The number of articles on industrial training was over twice as great in 1944-1948; however, the number of articles which might be classified as research showed no appreciable increase while descriptive articles were almost three times as frequent.

McGehee (30) was in agreement with Ryan (60) that if industry expects decisive aid from psychology in regard to training it must maintain research programs directed toward the solution of the broad fundamental questions which underlie its particular problems.

The subsequent review of literature includes reports of findings based on research, but also included are opinions and recommendations made on the basis of experience.

Scope of and need for training of employees

McGehee defined training as "those formal methods and processes in an industrial situation by which skills, knowledges, and attitudes of workers are developed or modified" (30, p. 84). Planty et al. said that the aim of industrial training should be to build continuously and systematically the "knowledge and those skills and attitudes which contribute to the welfare of the company and the employee" (56, p. 25). Training was recognized by most authors discussing industrial training as being broader in scope than the teaching of specific job skills. McGehee (30) pointed out that all workers from top management to the unskilled worker receive training, and he suggested ways of determining those personnel most in need of training. Many different types of training may be given, and usually the larger a concern the more varied will be the aspects of its training program.

According to the findings of a survey made by the National Industrial Conference Board (47), training programs increased greatly during the period from 1939 to 1946. In Table 1 is shown the percentage of manufacturing and nonmanufacturing companies that reported having training programs for various groups in 1939 and 1946.

Table 1. Percentage of training programs in manufacturing and nonmanufacturing companies

Group	Manufacturing		Nonmanufacturing	
	1939	1946	1939	1946
Top executives	4.6	5.2	8.3	13.1
Supervisors	15.5	32.4	21.5	40.7
Production workers	9.4	28.8	15.5	29.0
Apprentices	12.0	40.0 ^a		

^aApproximate figure for manufacturing and nonmanufacturing combined.

Mitchell, Vice-President - Food Production, The Stouffer Corporation, emphasized the need for training of personnel for their respective work, and stated that training is one of the important responsibilities of management in quality food production. She continued (41, p. 682):

Training is the basis on which efficiency is built. In the food service industry, training is essential, for our industry ranks first in the number of people gainfully employed per dollar volume of business. Our kitchens are not mechanized to the point where human hands and skills are not needed. True, we have many more machines today than we had twenty years ago, but they are simply aids in our quantity production work. Cooking and baking still require the skills of human hands and the pride of human beings.

These workers must be taught the skills of their jobs. They must be taught high standards of food quality and sanitation, and they must be trained in cooperative group working. Training accelerates correct learning, and it gives a worker greater respect for his job and greater pride and satisfaction in his work.

Training begins with, and is directed by top management. Food production and service is a detailed business, and management people must never forget that no matter how much they, themselves, may know about the work, they cannot operate the department without loyal employees. The better trained these employees are, the more efficient will be the operation.

Lundberg concurred with Mitchell's emphasis on the particular importance of training in the food service industry. He stressed an additional characteristic of institution work that made training especially important, that is, that many of the workers deal directly with the public and a mistake or the inefficiency of one employee may cause customer dissatisfaction or the loss of a customer. Lundberg classified the advantages of training as they related to management and to the employee (28, p. 97-98):

Advantages of Training to Management

1. Increased Learning Rate
2. Increased Quality of Performance
3. Decreased Breakage and Spoilage
4. Reduced Number of Accidents
5. Reduced Labor Turnover
6. Reduced Absenteeism
7. Increased Production

Advantages to the Employee from Training

1. Increased Earning Power
2. Prepares for Advancement
3. Enhances Self Respect, Increases Feeling of Security and Economic Independence

Other benefits cited by Planty et al. (56) included reduction of supervisory burden, reduction of overtime costs, reduction of machine maintenance cost, and reduction of grievances.

Responsibility for training

All writers in the field of industrial training seem to be in agreement that any training program to be effective must have the support of top management both in tangible ways, such as the facilities provided, and intangible ways, such as management's attitude toward the training personnel and its willingness to have employees attend classes on company time. There was in addition general agreement among the writers that two types of training, both on-the-job and class instruction, were useful in a training program.

There was, however, some difference of opinion in regard to who should do the training. Some authorities claimed that training is a line and not a staff responsibility. The more frequent view expressed is that when an organization is large enough to have a training department, re-

sponsibility for training should be shared by the line supervisors and the training department. Planty et al. described five alternative possibilities for fixing training responsibility (56, p. 30-35):

1. The Supervisor Trains Without Assistance.
2. Supervisor's Assistant Does Training.
3. Supervisor Does Almost All Training, Coached by Staff and Training Specialists.
4. Most Training Done by Staff Assistant at Request of Supervisor.
5. Initial Training Done by Training Department Before Employee Reports to Supervisor.

When supervisors function as training instructors, they need to know how to use effective methods of instruction (43). This generalization is in agreement with a report by Mair (35) who cited a study indicating that trainees' rate of learning a stitching operation was distinctly more rapid after trainers had received special instruction than it was before special teaching methods had been introduced to them. McGehee (30) likewise reported an instance in which the average learning time was decreased from 18 to 6 days by developing a definite training program and instructing the trainer in techniques of administering the program and teaching the trainees. McGehee concluded that the question of who is to do training becomes one of "selecting from among plant personnel those individuals who have the greatest aptitude for instructing others and training them in best available techniques of teaching" (30, p. 109).

McGehee (30) proposed that the responsibility for training should be placed directly upon the supervisors. This may be done by the staff personnel including the line supervisor as a partner in planning the training for his department from the initial job analysis on through to

evaluating the effectiveness of the training procedure. Parker and Kleemeier expressed agreement with this view when they stated that "Effective training departments function by improving and aiding the training done in production departments by production men" (52, p. 225). Morgan (43) was in essential agreement, but he added that it was the responsibility of the training department to provide the necessary outlines, materials, and visual aids needed for training.

Based on their experience, Planty et al. compared the relative advantages of having professional and nonprofessional teachers to do the training (56, p. 50):

Advantages of a Professional Teacher

1. The professional teacher places emphasis upon the learner.
2. He is usually broad, flexible, and adaptable and can teach a wide variety of subjects.
3. He is trained to accept and profit from supervision of instruction.
4. He is usually more capable of developing attitudes than is the nonprofessional.
5. He seldom creates inhibitions among trainees. He promotes group discussion and expression.
6. He has no special bias toward or allegiance to any one department.

Advantages of a Nonprofessional Teacher

1. Use of the nonprofessional broadens responsibility for training to many departments.
2. He knows practical aspects of jobs.
3. He carries more "weight" in teaching a specialized subject.
4. His own ability is improved while he is instructing others.
5. He can teach very technical subjects.

In the above comparison a professional teacher was interpreted to mean one who has a degree in education or similar qualifications. Such a person might be a member of the training department staff or a person not

regularly employed by the organization.

The professional teacher, not directly connected with an organization, may afford special advantage in some situations. For example, Odiorne (50) reported how joint union-management sponsorship of time-study classes cleared up suspicion of the rate-setting operation in a New Jersey ceramic firm, but that the Union was only willing to attend the classes if the course were given by an "outsider," preferably a professor from the university in that state. The work of Kleinschmidt (24), reported later, likewise exemplified an instance in which a professional teacher not connected with an organization functioned effectively.

Audio-visual materials

Extensive research has been done related to the development, use, and evaluation of audio-visual materials. Much of the research has been directly concerned with the use of these materials in the formal classroom situation; investigation has likewise been carried on relative to employee training. A review of the research completed during the period of 1918-1950 having to do with the educational effectiveness of motion pictures was made by the Instructional Film Research Program at the Pennsylvania State College (16). This project was jointly sponsored by the Department of the Army and the Department of the Navy. In 1953 the staff at this college completed an extensive bibliography on the production, use, and evaluation of instructional films (65).

Current editions of texts are available which present various aspects of the development, use, and evaluation of audio-visual materials. Perhaps

the most frequently used include those by Dale (7), Haas and Packer (15), de Kieffer and Cochran (21), Kinder (22), McKown and Roberts (33), Weaver and Bollinger (70), and Wittich and Schuller (72). In addition several texts related to supervision or training review the use of audio-visual materials in training, for example, the books by Morgan (43), Parker and Kleemeier (52), and Planty et al. (56). The present review consists mainly of a summarization of ideas and research findings on this subject which are of particular pertinence to the present study.

It is apparent from the literature reviewed that the contributions of audio-visual material to a learning process are dependent on both the appropriateness of the materials and the way in which they are used. The use of audio-visual materials is only one of several means of making teaching effective and may or may not be the best means of contributing to the attainment of the objectives in a given situation. Sensory materials are particularly useful to the teacher or trainer in making things clear to the learner, especially when the learner's background gives him no experience for visualization. The sensory devices used should be made a part of the total learning situation (7).

It is evident that although considerable research has been done on the production, use, and evaluation of audio-visual materials, there is conflicting evidence, and many problems and questions remain. Research in the field of television has broadened the scope of evidence and problems. The authors of the review of instructional film research from 1918-1950 stated (16, p. 1-2, 1-3):

After our examination of the experimental literature, we are impressed not with how much we have learned, but with how

little we know with reasonable certainty about films and their influences, and we are impressed with how little discrimination has actually been developed with reference to the various factors or processes that influence audience behavior by means of films. As a result, we are in the difficult position of discussing a medium of communication which has been subjected to very little discriminating analysis, even though the medium contains many variables that can be arranged in a variety of combinations in any specific motion picture on any specific subject, for any specific audience, for any specific purpose. On the other hand, progress has been made in determining the general effects of the medium and some of the factors which appear to determine this result.

McGehee went so far as to say (30, p. 108):

Industrial training units have used widely various mechanical aids, particularly visual, for teaching employees. Just how valuable are visual aids in training industrial employees? Are they equally effective in training workers at different levels or different jobs? Are they more effective in modifying attitudes than developing skills and knowledges? Frankly, I do not know. And I do not believe that many of the users of these visual aids know the answers to these questions. There are too few carefully controlled studies like those of Vander Meer (...) which approach these problems.

During World War II the production and use of audio-visual material increased tremendously. Much of the increase was in the Armed Services and in industry. In 1944 a Committee on Military Training Aids and Instructional Materials was appointed to examine the teaching aids and subject matter materials developed by the War Department and the Navy Department with a view to determining their possible usefulness in programs for civilian education and training. The committee report was mainly concerned with programs of job training in which training aids and devices have been principally used.

The training programs of the Services were based upon three points of approach (66, p. X):

1. The utilization of the most modern scientific testing and classification procedures whereby the skills and aptitudes of each serviceman are determined and used as a basis for his assignment to duty and to training.
2. The utilization of scientific job and operation analyses as the bases for curriculum building, and
3. The utilization of the tools and procedures of experiential learning to the utmost degree, as especially exemplified in the widespread use of training aids including audio-visual aids.

The Army and Navy chose to place great reliance upon the use of training aids and devices coupled with rigidly dictated training methods. Some of the reasons for such reliance upon aids and devices were (66, p. 7):

1. Their use is thoroughly established as an educational method, although always regarded in civilian education as an auxiliary one.
2. They eliminate the monotony of verbal instruction, create enthusiasm and interest in the subject, and assist in standardizing training.
3. The creation and use of aids and devices could be expedited coordinately with other methods and not at the expense of time or the use of other means.

Planning of the basic curricula included planning for the training aids needed, and provision was made by the services for the creation, distribution, and evaluation of the training aids. Most of the aids created were aimed to assist in the direct teaching of skills or in the learning of facts. An attempt was made, however, to achieve more abstruse and difficult objectives, such as the development of attitudes and general values not directly related to specific teaching situations.

Following is an outline of some of the specific materials, techniques, and devices which characterized the development and use of the training aids:

1. Use of films, film strips, slides, posters, graphic portfolios and other materials to assist in the creation of desired attitudes
2. Use of humor, "eye appeal," and naturalness to stimulate an interest in the immediate learning situation
3. Creation of material suitable to the level of ability of the learner
4. Use of a variety of aids and devices in order to reach various types of ability
5. Use of aids and devices to create training conditions which are as nearly as possible like real conditions of action
6. Creation of aids which emphasize the utilization to the maximum of the senses
7. Creation of materials which are functional; these are closely geared to the goals of training yet retain the maximum of general value
8. Emphasis upon integrated programs of "learning by doing"

A report was also made in 1946 by the War Training Program of the Division of Visual Aids for War Training on Training Films for Industry

(4). This report was concerned largely with the production of films.

Vander Meer (68) conducted an experimental study of the use of sound film in the training of engine lathe operators. Two (null) hypotheses were tested:

1. . . . that prospective engine lathe operators whose instruction includes the carefully integrated use of training motion pictures do not develop the essential skills to the required level in a shorter time than those whose training does not include such visual aids.

2. . . . that the trainees whose instruction includes motion pictures do not learn more technical information related to machine operations than do trainees whose instruction does not include such experience.

The first hypothesis was tested on the basis of a comparison of the number of minutes a trainee required per successful trial on twelve lathe jobs and average number of rejections per job. The basis for testing the second hypothesis was the difference between the scores on the Purdue Test for Machinists and Machine Operators.

The groups used in the experiment were seven consecutive classes of trainees. The first, fourth, and fifth classes were chosen as controls and were taught with the conventional lecture-demonstration method. The second, third, and sixth classes were experimental groups and received training in which films for lathe workers were made an integral part of the instruction although some demonstration was also included. The trainees in the seventh class were divided between the experimental and control groups. The number per class ranged from eleven to seventeen. The trainees ranged in age from 18 to 55, and about one third had completed four years of high school. There were three times as many women as men. The experimental and control groups were equated on the basis of age, education, and the results of a battery of tests. The tests included the Minnesota Paper Form Board, Wonderlic Personnel Test, Purdue Industrial Training Classification, Motor Ability, and Purdue Test for Machinists and Machine Operators.

The experimental film and non-film control group both completed a six weeks' training course after being told that they were subjects in an experiment. Treatment of the two groups was the same in all respects except

that a battery of U. S. Office of Education training films was used for the film group. Both groups had actual work on the machines in the beginner's, intermediate, and advanced machine shops. When films were used, the experimenter took charge of the mechanical details of the lesson so that the instructor could give his complete attention to his class.

Following are the findings and conclusions made regarding the group whose instruction included the use of motion picture films (68, p. 88):

- a) They require on the average less time per successful trial on the projects they are asked to turn out on the lathe.
- b) They do not sacrifice accuracy for speed in their work, for they do not on the average turn in more under-size jobs.
- c) They learn significantly more factual information on lathe operation.
- d) In view of (a), (b) and (c) it should be possible to shorten their training period by including motion pictures in their instruction in the manner described in this study.

The data supported some confidence in the following statements (68, p. 88):

- a) Insofar as their learning problems are similar to those of lathe trainees, time can be saved in the training periods of other types of machine operators through the use of motion pictures as training aids.
- b) Films are even more effective in saving time in teaching the more complicated skills and those in which a greater degree of precision is required, than they are in teaching less complicated and less exacting skills.
- c) A technique of film use involving careful timing and integration with other teaching; planned motivation, discussion, and evaluation in the actual film presentation; and efficient, unobtrusive manipulation of mechanical details is an effective method of visual teaching.

Incidental findings supported by the data included (68, p. 89):

- a) The trainees rate motion pictures superior to the lecture and reading in "helpfulness in learning," but inferior to teacher demonstrations and actual work on the machines.
- b) The best predictors of success in learning to perform lathe operations quickly and accurately are measures of motor ability, mathematical skill, and technical knowledge.

Vander Meer emphasized that neither films nor any other curriculum material can be evaluated apart from the methods by which they are utilized. He recommended that film lessons should be timed to come at the point in the student's progress at which they will be most helpful instead of grouping the showing of various films. Information needed to interpret a film should be given in advance, attention should be directed to important things to look for in the film, and there should be a review of the film following its showing and a continued reference to the film to help in making the transfer from the film to the application in actual situations.

In the event his study were repeated, Vander Meer suggested that the number of trainees be increased in order to achieve greater statistical reliability, and to require sufficiently more trials on each job so that it would be possible to get an adequate notion of the learning curve for each lathe operation.

O'Herron (51) developed and evaluated a training program for student waiters and waitresses at Whittier College. Forty-six students participated in the study, and more than two thirds of the group had less than one year of food service experience at the college. She prepared an instruction sheet, 25 colored slides, and a set of black and white photographs as instructional aids in the training program. A paper-and-pencil test was designed and administered before and after the training period to determine the extent of learning during the two and one half months of the training program. A rating scale was also developed to use in evaluating the on-the-job performance of the waiters and waitresses. Ratings by three persons were made in September and December, before and

after the completion of the four training lessons. A third rating was made by two of the three raters the following March. Additional information collected about each student included year in college, age, sex, major in college, grade point average, past food service experience, number of training lessons attended, hours worked, and percentile rating on the MacQuarrie Test for Mechanical Ability. Four group training sessions were held, and there was in addition on-the-job follow up of instructions. In an attempt to get the student employees to attend the training lessons, each session had to be repeated three or four times.

The mean scores on the pre-test and final-test were respectively 21.3 and 27.7. It was concluded that there was some positive relationship between the number of training sessions attended and knowledge acquired about the job. Food service experience seemed to be an advantage to students on the pre-test but not on the final-test. There appeared to be some positive relation between grade point averages and final-test scores. The use of the pre-test appeared to engender the interest of the waiters and waitresses for the training program and also gave a basis for knowing some of the points that needed to have special emphasis during the training and supervision.

Mean gains in rating scores between September and December were highest for students who attended four, two, or three sessions in sequence of highest gain, and between September and March for students who attended three or four training sessions. According to the ratings made, food service experience seemed to afford some advantage to on-the-job performance. Although there was some indication of higher rating scores for students with higher grade points, there were notable exceptions. Evidence

was insufficient to support a conclusion in regard to the relation between mechanical ability and quality of work as measured by the rating scales.

No relationship was evident between years in school and personal appearance and personal qualities, and the analysis made on the basis of sex in relation to other data collected did not provide evidence on which conclusions could be made.

The area in food service in which to date the greatest use has probably been made of audio-visual materials is that of sanitation. This fact is evidenced by an instructor's guide for training food service personnel, published in 1952, which included outlines for eight classes on the subject of sanitation and a comprehensive review of related visual aids available (67).

Some use has been made of visual aids in other areas of food service. For example, Pfeiffer (53) has reported the use of 4 by 5 inch color transparencies to instruct workers in a hotel in the proper preparation and plating of various food items. These transparencies were found, after some experimentation, to be more successful for this purpose than hand colored prints. Photographs were likewise used to instruct workers in the correct table place settings. Similar uses of photography in another hotel food service were reported by Goldrath (14). Raymond (57) produced two types of visual aids for the teaching of quantity food production and service, a series of 23 colored slides, How to Make Muffins, and a colored motion picture, Alice a Good Waitress. Hummel (18) prepared 50 slides on the operation of the floor-model mixer and 28 slides on the use

of the single-tank dishwasher as means of instructing students and training employees. In addition it is known that the food service units in many branches of the Armed Services are using audio-visual aids as a basis for instructing the food service worker in various phases of their food service operations.

Training the adult worker

Williamson and Lyle (71) recommended that the methods used to teach adults should vary according to the intellectual and educational level of the group, the type of development desired, the size of the group, and the facilities available. Consideration should also be given to the fact that adult groups have a tendency toward self-consciousness. It was recommended that adults take part in planning any program for them.

These authors presented the following fundamentals which have application in training employees. Interests of individuals can be modified; even if individuals do not have particular interests, it may be possible to develop them. Likewise, individuals may not recognize certain needs; however, they may be guided to recognize these needs. Adults are usually highly selective of subjects to which they will give time and effort; therefore, one must adapt a program to the adults. Often adults have fixed habits and habitual ways of thinking which they will change only when they can see the value of doing so. Whether or not the material offered adults will be accepted or rejected may be influenced by their past experience.

Recent experiments suggest that it is not the capacity of adults to learn that declines, but rather the rate of learning. The slowing process may be due to lack of practice. According to Knowles (25) and many other

authors in the field of adult education, mental ability reaches a peak during the late teens or early twenties, and then after forty years of age declines at the rate of about one per cent each year. Since adults may have physical impairments, it often is particularly important to have good lighting, good acoustics, audible speech, short meetings, and to proceed at a relatively slow pace.

Williamson and Lyle (71) did not agree with Knowles' suggestion of short meetings. They stated that adults can apply themselves to a task for a rather long period of time. The determining factor may be the motivation of the group.

The following incentives for adult learning which have been summarized by Lorge provide a valuable guide in planning a training program (27, p. 16):

People Want to Gain

- | | |
|------------------------|-----------------------------------|
| 1. Health | 8. Comfort |
| 2. Time | 9. Leisure |
| 3. Money | 10. Pride of accomplishment |
| 4. Popularity | 11. Advancement: business, social |
| 5. Improved appearance | 12. Increased enjoyment |
| 6. Security in old age | 13. Self-confidence |
| 7. Praise from others | 14. Personal prestige |

They Want to Be

- | | |
|-------------------------------|-------------------------------|
| 1. Good parents | 6. Influential over others |
| 2. Sociable, hospitable | 7. Gregarious |
| 3. Up to date | 8. Efficient |
| 4. Creative | 9. "First" in things |
| 5. Proud of their possessions | 10. Recognized as authorities |

They Want to Do

- | | |
|--------------------------------|---------------------------------|
| 1. Express their personalities | 5. Appreciate beauty |
| 2. Resist domination by others | 6. Acquire or collect things |
| 3. Satisfy their curiosity | 7. Win others' affection |
| 4. Emulate the admirable | 8. Improve themselves generally |

They Want to Save

- | | |
|---------------|---------------------------|
| 1. Time | 5. Worry |
| 2. Money | 6. Doubts |
| 3. Work | 7. Risks |
| 4. Discomfort | 8. Personal embarrassment |

On the basis of an investigation, McGehee and Livingstone (31, 32) concluded that a carefully planned training program to modify employee attitudes and actions toward a production problem carries beyond the initial training period for a considerable period of time. The effect of the initial changes, which resulted from training four employees in a textile plant to reduce waste, persisted for a period of 94 weeks. During the first 14 weeks there was some follow up of the original training program. There was also evidence that the effect of reinforcement of training at the end of the 94 weeks resulted in increasing the effect of training. A 61.6 per cent reduction in waste resulted from the first training, and this effect continued for 94 weeks; then when the training was repeated in a subsequent 26-week period a reduction in the waste ratio of 45.3 per cent was secured.

In the initial training the need for reducing waste was explained to the operators in a conference with the mill superintendent, the supervisors, and the operators. There was, however, no special effort to involve the

operators in group decision making, nor were any monetary rewards offered. Special instruction was given the workers for two weeks, and afterward there was follow up by the instructor-supervisor. Waste figures were posted, and, as a result of the success of the experiment, the operators received increased attention. McGehee and Livingston noted the fact that they used no control group and stated that this condition was typical of situations in industry where the outcome is the primary consideration rather than the means of achieving the outcomes.

The investigators concluded that the following basic principles accounted for the success of this training program (31, p. 121-122):

1. Presenting frankly, fully, and sincerely the reasons for any change to all who will be affected by it.
2. Enlisting participation, at their level of competence of individuals involved in the plan by assigning them specific tasks to perform.
3. Keeping the individuals involved informed concerning the outcomes of the project. This is the old principle of the knowledge of results.
4. Special recognition of individual workers assists in a program such as this. There are, however, limits to which special recognition merely accentuates the process and its withdrawal does not cause a reversal to the condition existing before such a plan was inaugurated.

Watson stated that to date the research about group decision substantiates the following conclusions (69, p. 26):

1. People are more likely to accept a changed pattern of behavior when they, themselves, have participated in planning it.
2. People are more likely to change their behavior if they see that other people like themselves are also planning and endorsing such a change in behavior.
3. People are more likely to act upon some request if they can be persuaded to commit themselves to a positive decision at the time they hear the request.

Some of the research supporting these generalizations is presented in the subsequent paragraphs.

Of particular pertinence to the present research is the study by Coach and French (6, 34) of the use of group decision and participation in overcoming resistance to job change. In the company in which this experiment was performed, it was often necessary to make changes in individual jobs or transfer workers from one job to the other. These necessitated a change in work patterns, and the workers resisted making the necessary changes. The workers were on piece rates, and when changes were made it was difficult for them to regain their previous rates. Transferred employees took longer to learn a new job than new employees. Various incentives had been offered to correct the situation, but these failed to prevent the hostility, grievances, low production, and quitting which resulted when changes were made. As a result of this condition an investigation was made, the primary purposes of which were to determine why people resist change so strongly and what can be done to overcome this resistance.

When changes were to be made which involved a large number of workers, groups of workers were handled in three different ways. The control group was treated in the usual way; after management had worked out the details of the change, they were explained to the employees, and assurance was given that the new rates established for the job made it possible for them to maintain their usual earnings. Experimental group I was told how management would like to go about setting up the change. There was no participation in the planning, but the group was told of the changes and accepted them before they were put into effect. For experimental groups II and III the need for a change in operation was presented; then the

groups participated in planning for the change with the time-study man. Certain members of these groups participated in setting the new rates.

As a result the control group exhibited the usual hostility and resistance when the change was effectuated; the usual slow job improvement for the new method was exhibited; and 17 per cent of the group quit within 40 days. There was practically no resistance to the change from experimental group I which had limited participation. Their recovery in rate of production was not as rapid as in the other two experimental groups, but none of the workers quit. For groups II and III, where participation was greater, there was no apparent dissatisfaction, a high rate of production was soon achieved, and none of the workers quit.

Later the control group was transferred to new jobs, and the total participation technique, described above for groups II and III, was used. This time there was lack of resistance during a 19-day period, and there was a rapid recovery in rate of production.

It was concluded from the results of this study that "change can be accomplished by the use of group meetings in which management effectively communicates the need for change and stimulates group participation in planning the changes" (6, p. 531). This experiment also confirmed the finding of earlier investigations that skill was a minor factor and motivation a major factor in determining the rate at which a worker learned a new procedure.

In another study on group decision, conducted by Bavelas and reported by Maier (34, 36), three experimental groups were used. Production goals were set in each group. The production attained was greatest, and the

high production rate was maintained longest by the group which set a production goal using group decision. When the goals were suggested by the leader or when the goals were discussed but no group decision was reached, there was no significant increase in production. It appeared that discussion without group decision led to little change in action, although it seemed to result in attitude change.

On the basis of these two studies and other supporting data, Maier (34) concluded that the concepts derived have important implications for training. Democratic leadership was proposed to replace autocratic leadership. In many situations this will necessitate not only a change in procedural techniques but often also a change in the supervisor or trainer and his conception of his role in relation to the workers.

Work Simplification Training

The benefits of work simplification and work simplification training are well supported by a review of the literature over the past fifteen years. Hudson (17) and Lipscomb (26) have reported on some aspects of this subject. Selected for review here are some examples of work simplification programs and specifically work simplification training. Problems encountered and recommendations made are given. There were many available reports of work simplification programs in industry; however, most of the programs reported which related to quantity food service were those conducted in hospitals. Although much of the literature was based upon the experience of individuals or organizations, two research studies were reviewed, namely those of Kleinschmidt (24) and Hudson (17). A report

of a survey made by the Sears, Roebuck and Company (61) is also given.

Work simplification programs in industry

Mogensen (42), who has had considerable experience in work simplification, in 1935 suggested ways to set up a program for motion economy. He believed that the benefits of motion economy when proposed by an outside "expert" may meet with antagonism because it is a common human trait to resent criticism. He suggested, therefore, that in order to achieve the objectives of motion economy it is necessary to enlist the cooperation of every single member of the organization, and in order to do this, one must work through the foremen. A training program in motion economy for foremen and supervisors was recommended. Such a program would make the work of the methods engineer or the time-study man easier and more effective.

According to Mogensen the training program for the foremen should consist of a definite series of meetings. In order to get the necessary background, the lecture method will probably need to be used for the first few meetings, but as soon as the men begin to try out the tools used in motion economy, the meetings can become a conference type. The subject matter being discussed during these meetings should be applied as quickly as possible to the group's peculiar problems. It was recommended that (42, p. S-146):

The best possible means of putting the training program into action is to devote at least one half of the time to finding specific solutions to plant operating problems, work them out to completion, and then use them as case material in instructing the groups. After each of these case problems has been

carried through as a group project, the ease with which further applications will be made, either in the same department or in different departments of the plant, is amazing.

The program for the foremen may be conducted by men trained to teach, such as instructors in university extension courses, by a consultant, or by qualified men from the plant group.

Aids suggested for use in the training program included: an outline of the material covered in each meeting so that the foremen would not need to take notes; process charts drawn large enough for the whole group to see; and motion pictures, particularly of operations before and after improvement. The value of pictures and simple motion pictures was emphasized. It was recommended that if possible the instructor visit each foreman on the job and go over with him the examples on which the foreman was working. The foreman groups should consist of individuals with a unity of interest. Meetings every two weeks were suggested.

The executives and top management personnel must likewise be trained in methods of motion economy. Mogensen emphasized the belief that frequently much of the time lost in industry is not as much the fault of the operator as of the management. Lack of planning, poor instruction, poor equipment or equipment maintenance, all responsibilities of management, are contributors to inefficiency.

Sears, Roebuck and Company (61) made a survey of 75 companies in a variety of types of industry, which had work simplification programs, to determine why some of these programs were successful and others were not. From the replies made to the questionnaire distributed to these companies the following findings were reported.

The greatest benefit of the programs was stated to be improved human relations; lower costs were also cited as a benefit. The way in which the program was started was considered crucial. Most companies sent representatives to courses held outside of the plant to be trained; others brought consultants into their plants or trained their own personnel. Most of the companies used training meetings as a regular and continuing part of their programs. It was believed essential to have a coordinator to run the program. Awards, refresher courses, and the like were used to keep the programs active.

For hourly employees the average number of hours in the initial work simplification courses was 16; the average for refresher courses was 13 hours; and the average frequency of refresher courses was every 18 months. The average hours for the initial courses for the supervisory and management groups was 22 and 18 respectively.

Of special interest to the present study was the question "How do you use photography to help your program?" Following is a summary of the responses to this question (61, p. 125).

73 of the 75 companies use motion pictures as a work simplification tool. And 88% of the companies feel that photography is either essential or important to the effectiveness of their work simplification programs. Almost all of these use it for training and methods analysis. But some companies use it for showing before-and-after results, to give recognition, and for inter-plant information.

58 companies have made their own motion or slide films for their work simplification programs.

An example of a work simplification program in industry is that of the Maytag Company (40). This company began a formal work simplification program in 1947. At the beginning of the program a specialist in work simpli-

fication presented the possibilities of such a program in about twelve hours of conferences, during a three day period, to the executive group for their approval. Later similar conferences were repeated for the top 48 men of the organization.

Subsequently two men from the company received additional training in work simplification and returned to the organization to provide training for approximately 200 line foremen and supervisors. An executive introduced the first session in order to indicate management's support of the project. For this group nine formal conferences of two hours each were presented. Each conference was limited to 12 conferees, and was conducted during working hours once a week. During the period of the conferences the leader made two visits to each supervisor on the job, to assist him in preparing a Flow Process Chart of some job under his jurisdiction and to develop an improved method. Supervisors were given considerable recognition for cost reduction ideas, but no cash awards were given.

Since the training of supervisors in work simplification was deemed to be so successful, it was decided to extend this training to the operator level in conjunction with a plan which paid cash awards to non-supervisors who suggested methods of reducing costs (37). Two additional men were trained to conduct these sessions.

A 10 hour program, four conferences of two and one half hours each, was presented. An illustrated booklet was prepared for use in conjunction with these meetings. Twelve conferees attended each of the sessions which were held during working hours, once a week for a month. Attendance was

compulsory, and employees were paid base rate for hours in conference. A member of management introduced the first program. Training in one department was completed before it was begun in another department.

These conferences were built around the theme of eliminating waste of supplies, materials, tools, scrap, and effort. Films of supervisory projects, showing the original and improved methods, were shown as well as various physical exhibits. As in the supervisor's training, preparation of a Flow Process Chart was included in one of the sessions.

Standardized procedures and forms were established for processing ideas submitted by the supervisors and operators (38). A detailed statement of policy was set up to cover the payment of awards to operators. In general the award was defined as one half of the first six months net manufacturing cost reduction in labor, materials, and supplies. Only employees who had attended the 10 hours of conference were allowed to submit ideas as a basis for cash awards.

Following is a summary of the outcomes of the Supervisor's Work Simplification Program and the Employees' Idea Program, for the six year period 1949 through 1954; in 1954 the company had approximately 4,000 employees, (39, p. 1):

Supervisor's Work Simplification Program

Projects submitted	1985
Projects installed	864
Gross cost reduction	\$1,183,206.40
Cost of installation	\$ 211,237.94

Employees' Idea Program

Ideas submitted	1931
Ideas installed	626
Gross cost reduction	\$275,950.37
Cost of installation	\$ 32,419.20
Average award	\$ 101.12
Total amount of awards paid	\$ 63,298.74

Kleinschmidt (24) developed an industrial training program, the objective of which was to assist smaller industrial companies toward more effective cost reduction work. The training program was applied in two selected companies. Personnel included in the training groups were the purchasing agent, the methods or time standards man, the chief designer or engineer, the superintendent of production, and a representative from the cost accounting department.

Although neither the area of training nor the group being trained was comparable to that in the present study, the conclusions reached by Kleinschmidt have some pertinence (24, p. 111b-112):

The results of this investigation indicate that within the limits of the experimental testing of the training program, the following conclusions are valid:

1. Smaller industrial concerns may benefit financially by use of the training program.
2. The training can be effectively undertaken within the plant, and without the use of elaborate training aids.
3. Personnel with widely varied training and experience backgrounds are able effectively to participate in the same training group.
4. It appears to act as a "catalyst" in securing improved inter-departmental cooperation by those participating, and it furnishes a definite procedure which facilitates effective use of personnel in the problems investigated.
5. The results secured may be attributed to the following factors, some of which are a direct result of the training; others are contributing factors.
 - a. The stimulation of group action.
 - b. Technical skills of individual members of the groups.
 - d. A new perspective for members of the groups.
 - e. New channels of communication within the companies.
 - f. Use of an "outsider" to lead the training.
 - g. Active support from top management.
 - h. Greater facility in initiating operating changes.

Work simplification programs in hospitals

Hudson (17) studied the application of management engineering to nonrepretitive work using hospital nursing at the State University of Iowa as an example. The main purpose of Hudson's research was not parallel to the present research, but some of the considerations, techniques, and outcomes have implications since much of the work in a food service operation is nonrepetitive in nature.

The distinction between repetitive work and nonrepetitive work was said to be essentially one of degree. The extent to which all of the major direct considerations affecting the work can be preplanned was a distinguishing factor. Specific criteria were given for identifying repetitive work.

Hudson pointed out that industrial engineering techniques have been applied to work which is considered to be nonrepetitive. He cited three areas of such application, namely, auxiliary factory services such as maintenance and transportation, office work, and agricultural work. According to Hudson, the work done in these areas has been on a specific basis. He believed that a general viewpoint and approach was needed.

Among the principles of analysis for nonrepetitive work, proposed by Hudson, the following one is of particular significance here (17, p. 24):

Adequate attention must be paid to securing the cooperation and, if possible, the participation of the group being studied. In nonrepetitive work this is particularly important because clear-cut evaluation of individual contributions to production is not usually possible. This means that direct rewards and penalties are not available for insuring continuation of improvements. Under these limitations the hope for perpetuating the changes must rest largely on the acceptance of the group involved. Group participation, particularly in analysis and synthesis, is to be considered a standard procedural step.

The techniques and devices used by Hudson in his study of the nursing service included the following (17, p. 28):

1. Work sampling (Ratio-Delay Study)
2. Process analysis (Process Charting)
3. Process analysis (Flow Diagraming)
4. Written standard procedure (in modified form)
5. Time study, direct observation (considerably modified)
6. Memomotion study
7. Layout studies
8. Job manual (general section only)
9. Correlation analysis for staffing criteria study
10. Activity study

Hudson found during the process of his research in nonrepetitive work striking parallels with common group reactions experienced in industry. He believed that these findings, excerpts of which are quoted below, have pertinence to a hypothesis of the general expectation of such reaction in all human work situations (17, p. 75-81).

1. Expectation that the solution to job problems lies principally in physical facilities provided by management. The worker in both work situations (hospital and industrial) is quite willing to accept the industrial engineer as a resource for securing revised layout, new work place design, new tools, fixtures, and handling facilities. The worker is correspondingly reluctant to receive suggestions that his own and his teams' work habits be revised as a major contribution to solving the job problems.
2. The conviction that "our work is unique" with respect to work planning and execution. . . .
3. The conviction that, under the conditions encountered in the work, the group has already worked out about as good a way of planning, assigning, and executing the work as could be reasonably expected. . . .
4. Workers' pressure for action. In both work situations a point is reached at which the workers tire of fact gathering observations and start exerting pressure for taking action on the basis of facts already at hand. . . .

5. The point of slump in interest. In both work situations a point is reached at which, in spite of careful indoctrination, the workers' interest in the project slumps. . . .
6. Essential need for incentives or substitute rewards. In both work situations it has been observed that the workers frequently behave as though they attach definite values to freedom in planning and carrying out tasks.

On the basis of his findings, Hudson supported the proposition that the common techniques for process analysis and layout are suitable for application to nonrepetitive work but that the techniques for operation analysis are not likely to be generally appropriate for analysis of non-repetitive work.

Gibbs (13), in his introduction to the report of the Committee on Methods Improvement of the Council on Administrative Practice, American Hospital Association, emphasized the need for methods improvement in hospitals. It was recommended that a job of methods improver be established in hospitals to carry on a continuing program of methods improvement above and beyond that which could be done by the administrator and his department heads. On the basis of the Committee's studies of work simplification programs, Gibbs reported that (13, p. 8-9):

. . . . the most successful organized methods improvement deals with the part of hospital management that gives over-all direction to the development of better ways of performing both individual tasks and those participated in by more than one individual or department. It discovered that such a program (1) sponsors supervisory training programs in work simplification; (2) assists in performing the part of methods improvement that is above the capacities of individual workers; (3) provides planned guidance and specialized help to personnel of all hospital departments in evaluating and improving methods; (4) is advisory and helpful in its nature and has no operational responsibility; and (5) furthermore, requires that whoever is responsible for such activity report directly to the administrator.

Gibbs stated some, although not all, techniques developed in industry for methods improvement are applicable to hospital operation. He said that although methods improvement is the responsibility of the administrator, it is essential to have all levels of supervision, plus all employees willing to cooperate. Considerable cost reduction and better patient care are direct outcomes of a methods improvement program, but a valuable by-product lies in greater interest in the job at hand on the part of all participants.

The Committee report included several case studies of hospitals in which organized methods improvement programs have been established. One example was at the Blodgett Memorial Hospital (75), Grand Rapids, Michigan. Here one of the staff was assigned to a full-time job as "Supervisor of Methods Improvement." She functioned as a staff person, reporting to the director through the assistant director of the hospital. The benefits of this program were summarized as follows (75, p. 23):

We feel that through the methods improvement activities in our hospital we have made two major accomplishments. First, we have improved patient care because of: (1) better use of physical resources, (2) more effective use of equipment and materials, (3) higher morale resulting from increased interest and training programs, (4) identification of trouble spots and breaking of bottlenecks, and (5) constant review of present methods with improvement of specific functions in mind. Secondly, we have brought about savings in time, material, and equipment within the scope of best possible patient care with our existing facilities.

On the basis of their experience, it was emphasized that it is essential to the success of a methods improvement program that all personnel understand the "why" of the program so that feelings of job insecurity will not develop.

In other hospitals the programs were organized and administered differently. The local chapter of the Society for the Advancement of Management helped initiate the program in one hospital (73). In another unit of hospitals a new staff position was created in order to give more attention to studies of methods in the hospital (3). In addition students from the university, of which the hospital was a part, were given laboratory experience in the hospitals in methods improvement, and the hospital thereby received the benefits of closer analysis of some methods than the hospital personnel would have been able to give. Two hospitals located in the same city employed a graduate industrial engineer to head up their methods programs, and a methods department, as a staff-level function, was established in each hospital (11). In another hospital two of the assistant directors, who were given special training in work simplification, shared the responsibility for developing a methods improvement program (45). In one instance the methods improvement program was conducted with the aid of an industrial consultant (12).

On the basis of the experience in one of these hospitals which was purported to have a very successful work simplification training program, the following recommendations were made (73, p. 17):

One of the pitfalls to be guarded against is to remember the slogan that the person on the job is the best one to improve the job. His ideas and suggestions should be asked and applied where possible, and he should be credited for them. Education as to what is being attempted must start at the top and go down through all personnel. Make haste slowly. Take employees into your confidence, and always report back what has been done. Avoid efficiency-expert attitude. Remember that better methods are developed by evolution rather than by revolution.

DEVELOPMENT OF THE WORK SIMPLIFICATION
TRAINING PROGRAM FOR FOOD SERVICE EMPLOYEES AND
METHODS FOR COLLECTING EVIDENCE TO INTERPRET OUTCOMES

The present research problem was planned as a result of a recognized need for the development of methods and materials for teaching work simplification to food production and service employees. The problem was to select appropriate available visual materials, to develop additional ones, and to experiment with a training program using the visual materials. It was designed to secure information relative to the outcomes of the training program in order to formulate hypotheses regarding the training of employees and specifically the use of visual materials for teaching work simplification generalizations. A further expectation was that this research would provide a basis for making recommendations concerning methods of research for similar studies.

In addition to planning the work simplification program and selecting and developing visual materials for use in the training it was necessary to devise means for determining the outcomes of the program. A set of tests was developed to be administered to the workers participating in the training program. Specific work processes in the food service were analyzed, and improvements in the processes were developed; workers' contributions to the development of improved methods and their reactions to the new methods were likewise used as a basis for evaluating the effectiveness of the training program. The attitudes and comments of

workers during the training classes were also noted. To aid in interpreting the outcomes, the supervisors were asked to rate each worker on selected characteristics, and certain personal data about each employee were collected.

Prerequisite to the development of visual materials to be used for training food service employees in work simplification was the need to define explicitly the objectives of such training. These objectives, presented in the Introduction, were formulated on the basis of exploratory work done in the preliminary stages of the research planning. A review of the pertinent literature was made, and informal interviews were conducted with dietitians and food service workers. This work culminated in a summarization of ideas or basic statements in four areas, namely, work methods in relation to the functions of management, training of workers, adult education, and work simplification.¹ These statements were criticized by four specialists in the respective areas, and revisions were made until they were acceptable to those consulted as representative of current views. On the basis of these considerations, the proposed objectives were formulated.

Since it is desirable to plan any program of training to meet the needs of a specific group, consideration was given early in the planning to the selection of a food service unit in which the training program in work simplification might be conducted. It was believed essential, for the effective administration of work simplification training for workers, that the administrative and supervisory staff of the organization selected

¹The consensus of these basic statements are incorporated into the supporting material presented in the Introduction.

be interested in improving work methods and be willing to cooperate in such a program. Knowing that the administrators responsible for the food service unit in the men's residence hall on The Iowa State College campus were interested in work simplification, they were contacted, and after the purposes of and plans for the work simplification training program were explained, the author was assured complete cooperation with the research project. On the basis of the exploratory work done for the present research, it was believed that workers do not generally see a need for training in the area of work simplification, and that it is necessary that part of the training be a development of interest and recognition of need. Workers' recognition of need for work simplification training was, consequently, not considered as a criterion in the selection of the food service unit in which the training program in work simplification might be conducted.

Following is a brief delineation of the sequence of procedure. Conferences were held with the Dietitian and her supervisory staff to explain the development of and plans for the training program before its introduction to the workers. Then a group meeting was arranged for the introduction of the program to the workers. After this an interview was held with each employee at which time two tests were administered and personal data were collected. At selected periods during the next four weeks, observations were made by the author in the food service unit to study and analyze the methods of work being used. Then, over a period of three and one half weeks, a work simplification course of seven classes was conducted for the workers. Following the classes new methods of work, developed on the basis of the studies made, were

introduced during a period of approximately four weeks. At the end of this period interviews were again held with the employees; the third and fourth tests were administered, and the reactions of the employees to the training program were secured. Approximately six months after the first two tests were given they were administered again.

The development of the training program and the methods for collecting evidence to interpret outcomes included three aspects: a definition of work simplification generalizations on which the program would be based, selection and development of visual materials, and the development of tests and other means for interpreting the outcomes of the training program. These aspects are presented in the subsequent sections.

Work Simplification Generalizations

One of the fundamental steps in the development of the work simplification training program for food service employees was the selection of generalizations to be used. In order to include appropriate generalizations, a review of the literature related to work simplification was made, and the generalizations selected were then submitted for consideration to three persons experienced in quantity food production and service. These generalizations were stated as guides and will be referred to as guides to work simplification. They formed the basis for the organization of the training program and the selection and development of visual materials.

A question considered in the development of the generalizations was

the type of changes in job methods with which food service workers would be most concerned. Mundel, who has done extensive work in motion and time study, stated that in order to improve the work method for any job it may be necessary to introduce changes in any one of the five areas that affect its performance. These areas were given as (44, p. 23-24):

1. Hand and body motions

The particular motions, their sequence, and their nature may be changed to ease or improve the task.

2. Work station (tools, workplace layout, or equipment)

The design of any single work station or the equipment used for any part of the task may be modified.

3. Process or work sequence

The order or condition in which the various work stations receive the product may require change or the number of work stations may be modified.

4. Product design or form of goods sold or material sent out

The final form of the product, as it leaves the organization, may require slight modification to facilitate the attainment of the objectives of improvement.

5. Incoming supplies or raw material

The materials brought into the organization may require change in form, condition, or specification in order to allow the desired improvements to be made.

It was recognized that, although workers might suggest changes in regard to the fourth and fifth areas, there would seldom be an opportunity for them to make direct application of such changes in their own work situations, for a change in the product or raw material would always necessitate a decision by management.¹ Therefore, although areas four and

¹See discussion of responsibility for work methods in the Introduction.

five would be essential to consider in a work simplification training program for supervisors or top management and might be introduced in a program for workers, it appeared wise to emphasize the first three areas in the present program. The following adaptation of Mundel's classification was used as a basis for selecting and organizing the guides to work simplification:

Tools, equipment, and workplace

Hand and body motions

Work process or sequence

The guides were organized according to their expected use in the training program rather than in the sequence given by Mundel. Those related to tools, equipment, and workplace were listed first in the belief that workers, during the initial steps in the training program, would be more at ease if the guides presented related to their tools, equipment, and workplace rather than to themselves. Furthermore, in the present study, the interpretation of the three areas varied to some extent in that certain guides which would be classified by Mundel within areas four and five were delegated to one of the above areas.

After the guides were formulated, situations which exemplified each guide were listed. The guides and examples were presented for review to three persons experienced in quantity food production and service who were asked to consider the following:

1. Were the guides appropriate as a basis for work simplification training for food service workers? Were additional guides needed?

2. Considering the expected use of the guides, could any suggestions be made to improve the wording of the guides as they were stated?
3. Were the examples for application of the guides in large quantity food service appropriate? What other examples might be added?

One of the persons who reviewed the proposed guides questioned whether workers should be given an opportunity to make decisions in regard to methods used. Before complete agreement was reached it was necessary to review the objectives of work simplification training for workers.¹ The explanation was made that the objectives were proposed with recognition of the following fundamentals: that the methods used are critical to the outcomes expected; that in any operation close control by management of the methods used is essential; and that the over-all organization of the work by management and the facilities provided by management are often the chief determinents of the methods used. The question raised indicated the importance of emphasizing the points concerning the responsibility of management for work methods² in relation to the objectives of a work simplification training program for workers.

The three persons who reviewed the guides and the examples for each guide made some suggestions which helped in determining the final statements of the guides and in selecting appropriate examples. None of

¹See proposed objectives of work simplification training in the Introduction.

²See discussion of responsibility for work methods in the Introduction.

the proposed guides was deleted, however, nor were any guides added.

The examples were used in developing colored slides, in preparing an illustrated booklet, and in the discussion of the guides during the training classes. The guides developed are given below:

Guides to Work Simplification for Food Service Workers

A. Tools, equipment, and workplace

1. Use the available equipment that is best for the job
2. Keep tools, equipment, storage and workplace in good working order
3. Have equipment and supplies within easy reach at the place where they are used

B. Hand and body motions

1. Let both hands do useful work at the same time, when possible
2. Perform work in a rhythmic way - use smooth continuous curved motions
3. Use the fewest, shortest, and simplest motions
4. Maintain a comfortable working position, and bring the work you are doing right in front of you if possible

C. Work process or sequence

1. Arrange work areas to eliminate unnecessary walking or reaching
2. Eliminate or combine parts of a job, if possible
3. Plan the order and time of work for best results
4. Standardize procedures to eliminate need for repeated decisions.

Visual Materials

Having selected the generalizations, the work simplification classes were planned, and appropriate visual materials were selected or developed. A description of the visual materials follows; each class is described in the section on Work Simplification Classes.

Visual materials selected

Two types of visual materials were selected to contribute to the objectives of the training program: motion pictures and an illustrated booklet. A review was made of current periodicals, lists of visual materials published by professional organizations, and film catalogs to determine what visual materials were available that could be used to advantage in the work simplification training program for food service workers.

On the basis of the information given about the motion pictures, filmstrips, and slides in the various listings, 21 motion picture films or filmstrips were previewed. Five motion pictures were selected for use in the training classes. During the training program one additional short film, that had to do with methods of sweeping, was shown to the men workers who were specifically concerned with cleaning of floors. These six films are described briefly in Appendix A.

The criteria used for selecting a film were as follows:

1. The film should exemplify the application of some of the guides to work simplification, provide evidence of the

benefits of work simplification, or demonstrate briefly the procedures followed to simplify work.

2. Preferably, the film presentation should be related to work similar to that done by food service workers.
3. The film should be short enough to be used effectively in a 30 minute meeting.
4. The main purpose of the film should be related to some aspect of work simplification.

Although many excellent motion pictures were available that could be used to advantage for training food service employees in other aspects of their work, only one of the films selected met all five of the criteria; this was the film Skill Counts at the Sandwich Counter. The other films were selected from those previewed as being the most useful of the ones available. Consideration of the use and relative merits of the films selected will be found in the description of the training classes.

The booklet Easy Ways (10) was selected for distribution to all of the workers during the training program. This booklet is related to work simplification applied to homemakers' routine tasks. One of the bases planned for securing the cooperation and interest of the workers in the training program was to point out that work simplification could be applied to advantage in their personal lives as well as on the job. The great majority of the workers for whom the training program was planned were women with homemaking responsibilities, and it was believed that this booklet could be used effectively to demonstrate the application of work simplification to homemaking.

Colored slides developed

Two series of colored slides were developed for use in the training classes. A total of 125 slides were made; from these 64 were selected, and three of these were used twice. The slides are described briefly in Appendix A in the order used. One group, No. 1 through 19, was made to depict the application of work simplification principles to the work process of table setting. The remainder of the slides exemplified ways in which the guides to work simplification could be applied in quantity food production and service.

Data from Lipscomb's (26) study were used as a basis for the first series which was related to the improvement of the table-setting process. After studying the work process, as presented by Lipscomb, the slides were planned, and a description was made of each proposed slide. The pictures of the actual work process were taken in the dining room of the Institution Management Tea Room where Lipscomb originally made her study. Flow diagrams for the original and improved methods were photographed from the original drawings of diagrams in her thesis, slides No. 11 and 15. The slides of the process chart and of the table concerning the original and improved methods were developed on the basis of data given in the thesis, slides No. 18 and 19. The purposes in using this series of slides were: to motivate workers to accept the work of a job analyst and to become interested in work simplification, to motivate workers to accept and use new job methods as they are developed, to provide an example of how a job may be simplified to make it easier and less time consuming, and to exemplify the work of a job analyst and

the procedures followed to develop an improved work method.

The second group of slides, those developed to exemplify the application of the guides to work simplification, were made to be used as a basis for discussion during the training program classes. Situations were selected which were appropriate for a relatively large food service unit such as the one in which the training program was to be conducted. Further, the slides were planned to supplement the visual aids which had been selected, and an attempt was made to choose situations which could be portrayed effectively by colored slides. A difficulty encountered was the unavailability of situations to be photographed that would be suitable according to these factors. In some instances alternative situations or methods for one job were photographed; in a few cases, however, only one situation was used.

Most of these pictures were taken in the kitchen of the Institution Management Tea Room. Those situations which did not include food were photographed at times when the kitchen was not being used by classes. When situations did include food, permission was secured from the instructors to take pictures during the laboratory classes. By studying the menus, a schedule was made for taking the pictures, but a few times it was not possible to take the exact situation planned. Also occasionally situations were observed which were equally as appropriate; so they were photographed instead of or in addition to those which had been planned. A few of the slides were taken in the food service unit where the training program was to be conducted. Arrangements were made in advance with the Dietitian regarding the most convenient time to take

the pictures. Two slides, No. 61 and 62, were made from the original drawings of diagrams in Lipscomb's (26) thesis.

It was recommended to the author that she be the person photographed in order to eliminate the distraction to viewers of the slides of having different individuals included. With a few exceptions, it was possible to follow this recommendation.

The arrangement of the layouts for the pictures was often very time consuming. In some instances, too, in which food was a part of the situation to be photographed, it was possible to take only one or two situations at one time because the taking of these pictures was dependent on the food production schedule. These problems became apparent as the arrangements for the slides developed; consequently the original plan of having a professional photographer was abandoned. It was not practical to secure a photographer to take pictures of only one or two situations and to wait during periods of food production until the specific time that a situation occurred.

Owing to the problems just described, the author photographed as many of the pictures as possible, even though she had had practically no previous photographic experience. More than half of the pictures were taken by her directly or the situations were arranged and the camera set by her; then whoever was available was asked to activate the camera while the author posed in the picture. The remainder of the pictures were taken by two persons with more experience. The pictures were taken over a period of approximately three months.

Two 35 mm. Kodak cameras with Kodachrome film were used. Flash

exposures were made, and for most of the pictures the camera was placed on a tripod. Two or three pictures were taken of each setup; sometimes variations were made in the setup for these repeat pictures in an attempt to find the best type of arrangement from the photographic standpoint. The slides made from diagrams and printed material were produced by The Iowa State College Photo Service Department.

A discussion and evaluation of the slides are included in a later section, Work Simplification Classes. Prints of two of the colored slides are shown in Figures 1 and 2.

Illustrated training booklet developed

An illustrated booklet was developed to be used in the classes on work simplification. Specifically the booklet was designed to aid in introducing the program to be followed in the classes, and in presenting the guides to work simplification. It was expected also that, by reference to this booklet at each of the classes, continuity from one class to the next might be accomplished. The booklet was planned to be attractive in appearance and of interest to the group of workers. Simple terminology was used, and the ideas stated were illustrated with line drawings. The examples chosen for the application of the guides to work simplification were ones that were appropriate to the food service organization in which the training program was to be conducted. A copy of this booklet is in Appendix A.



Figure 1. Colored Slide 20. Placing Filling for Meat Turnover, Using a Spoon

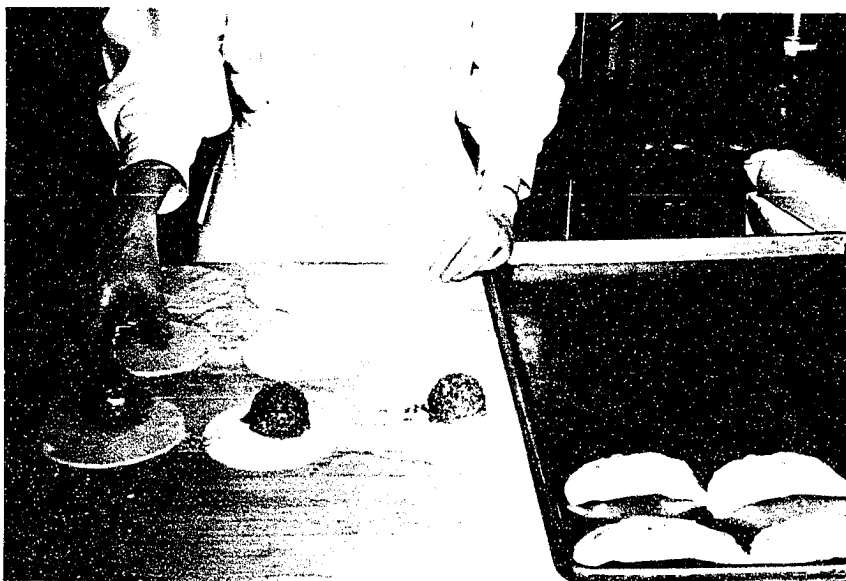


Figure 2. Colored Slide 21. Placing Filling for Meat Turnover, Using a Scoop

Situation Tests

Four tests were designed which involved work situations that could be improved by application of work simplification generalizations. The problems were presented through motion pictures, and the subjects to whom the tests were administered were asked to give suggestions for simplifying the work processes involved. These tests, hereafter referred to as situation tests, were to be one basis for determining the outcomes of the work simplification training program for food service workers.

The first two of the situation tests were administered individually to the workers participating in the training approximately one month before the training classes began, and the third and fourth were presented one month after the classes. Tests number one and two, given before the training classes, were repeated approximately four months after the conclusion of the training classes. As one basis for analyzing the responses of the workers to the situation tests, the four tests were also administered to another group that did not participate in this training program.

Work situations planned

The objective, when planning the work processes to be used for the situation tests, was to depict jobs done in such a way that there would be considerable opportunity for suggesting ways of improving the methods used. It was necessary also that the possible suggestions for improve-

ment involve application of the guides to work simplification which had been previously developed as a basis for the training program. In addition the work processes were to be ones normally done in quantity food production and service. An attempt was made, however, to present work processes which were not a regular part of the jobs of the workers participating in the training program, but it was possible to plan only one situation which was not at some time a part of the work done by at least a few of the workers. The four work processes selected were as follows:

1. Serving soup at a cafeteria counter
2. Making sandwiches
3. Eyeing potatoes
4. Setting up trays in the floor kitchen of a hospital

Preliminary to filming the pictures for the tests, the four situations were demonstrated before a group of four college students, two laboratory attendants, and one instructor. Each work process was demonstrated twice, and after each demonstration the group was asked to record suggestions for improving the methods used in the work process. The responses of the group were studied to ascertain whether application of every work simplification guide was exemplified in at least one test. These demonstrations also provided an opportunity for the author to practice the work processes in preparation for the later filming and to determine the approximate time necessary to perform each task.

Motion pictures made

Arrangements were made for filming the motion pictures in a hospital

in a nearby city. By visiting the hospital before the time of filming, it was possible to plan the locations for taking the pictures. Properties needed to structure the work situations were selected, and a schedule for photographing was worked out with the dietitian in charge of the food service.

The actual photographing of the work processes was planned with the assistance of The Iowa State College Film Production Unit, and the motion pictures were taken by a photographer from this department. A Bell and Howell 7ODL 16 mm. motion picture camera and Eastman Tri-X negative film were used. For only one of the four situations filmed was it necessary to provide light in addition to the regular light in the room. The author performed all four of the work processes for the filming; in the sandwich making process she was assisted by two of the hospital employees.

After the films were developed and one print was made, the motion pictures were edited. Then a duplicate print of each work process was made so that the situation could be shown twice for each test without rewinding the reel.

The decision was reached to use the motion pictures related to serving soup and making sandwiches as a pre-test and those of eyeing potatoes and setting up trays as a post-test following the training classes. This decision was based principally on three facts. First, the running times of the films were 1.37, 3.00, 1.44, and 3.22 minutes respectively. The above combination of pictures made it possible to have a short and a long process for each set of tests. Second, since one

of the motion pictures to be used in the training classes was specifically about sandwich making, the sandwich making process was not considered appropriate as a test soon after the training program. The reason for this belief was that the exact methods recommended during the training class could be easily transferred to the test situation, and the test would therefore not provide an opportunity for application of generalizations. Third, the above combination of films provided for a food production and a food service job in both the pre-test and the post-test.

Since each motion picture was to be shown twice, the two prints of the picture of serving soup were followed on one reel by two prints of the picture of making sandwiches. Two prints of the pictures of eyeing potatoes and setting up hospital trays were similarly combined on a second reel. The motion pictures developed are on file in The Iowa State College Institution Management Department. A picture taken during the filming of each work process is shown in Figures 3, 4, 5, and 6.

Administration of tests to workers planned

It was planned that the situation tests would be administered individually to the workers participating in the training program. After an oral introduction the motion picture of each work situation was to be shown twice, and after each showing the worker was to make his responses orally to the author. A second showing of the film was considered desirable in order to remind the worker of points not covered in responses made after the first showing and to give him an opportunity to observe the work situation further. Having the responses made orally

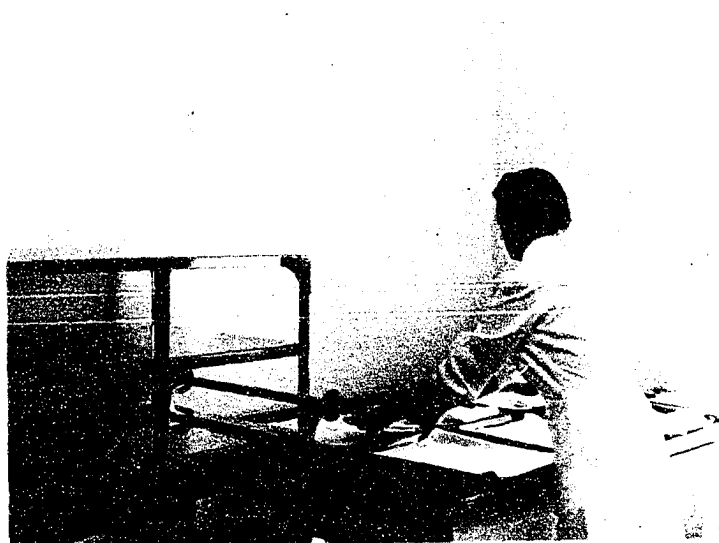
Fig. 3. Situation Test. Serving Soup at a Cafeteria Counter

Fig. 4. Situation Test. Making Sandwiches



Fig. 5. Situation Test. Eyeing Potatoes

**Fig. 6. Situation Test. Setting Up Trays in the Floor Kitchen
of a Hospital**



was believed desirable in order to eliminate the effect of any differences among the group in ability to express their ideas in written form. The author was to record their responses in writing and by a tape recorder. The actual administration of these tests to the workers will be described further in the section on Administration of Tests to Employees and Collection of Additional Data.

In order for the author to secure some practice in administering the tests and recording the oral responses, the four tests were given individually to four persons not in the training program. The responses made were recorded both in writing and by a tape recorder.

Tests administered to student group

The four situation tests were administered to a group of 30 college students in an Institution Management class during part of a laboratory period. Half of the group was given the pre-tests first and the other tests last. The sequence was reversed for the other half of the class. Varying the sequence in which the pictures were shown was done in an attempt to equate the effect, if any, of the order in which the tests were taken.

To equalize the two groups to some extent from the standpoint of their understanding of work simplification, the students were divided according to the number of courses which they had completed that were known to include instruction in work simplification. The names of the 14 students who had had two courses were arranged in alphabetical order, and every other name was selected for group A; the remainder were placed

in group B. The names of the 12 students who had completed only one of the courses were likewise arranged in alphabetical order and were distributed among the two groups in a similar manner. The names of the four students who had had neither of the courses were also distributed equally between the two groups.

Each test was introduced by a short oral description of the work process to be shown. The students were asked to give suggestions for improving the job or for making the job easier or more efficient and were instructed to record their suggestions for each test on a separate sheet of paper. The plan for showing the films and the way in which they were to record their responses were explained. Five minutes were allowed for writing responses after the first showing of each work situation; and three minutes were allowed after the second showing.

In addition to the 30 students, two instructors wrote responses to the tests in order to study the tests and evaluate the procedures used.

Score sheets made

On the basis of the original plans for each test and the responses of the student group and two instructors, score sheets were developed for scoring the responses to each test. The criteria for scoring the situation tests and the scoring procedure followed will be described in conjunction with the interpretation of the scores. Copies of the score sheets are on file for inspection in The Iowa State College Institution Management Department.

Collection of Information about Employees

It was considered desirable to secure some information about the individual employees participating in the training program to use in analyzing and interpreting the outcomes of the program. Data to be collected about each employee were of two types: the supervisors' rating of the employee and personal data.

A rating scale was set up to secure the supervisors' rating of each employee for the following factors: disposition and cooperation with supervisors and co-workers; quantity of work; quality of work; dependability; ingenuity; job satisfaction; and effort (physical and/or mental in performing work done). An estimate of the skill required for the job which the worker held was likewise requested on the rating scale form. A copy of the rating scale is in Appendix A.

Since it was known that the employees varied greatly in many respects, it seemed desirable to collect certain information about them. Personal data secured about each worker included a description of his present job, his previous work experience, education, work preference, age, sex, and physical defects. A form was designed on which to record the personal data about each employee. A copy of this form is in Appendix A.

CONDUCTION OF THE WORK SIMPLIFICATION
TRAINING PROGRAM FOR FOOD SERVICE EMPLOYEES
AND COLLECTION OF EVIDENCE TO INTERPRET OUTCOMES

The food service unit in which the work simplification training program for food service workers was conducted was in the men's residence hall on The Iowa State College campus.

Approximately six months before the introduction of the program, the main kitchen and dining unit had been expanded, completely remodeled, and new equipment had been installed. The kitchen was located between two dining rooms with two cafeteria counters between the kitchen and each dining room. In addition to the two main dining rooms there were several smaller rooms for special meal service. During the period of the training program, there were seldom more than three of the four cafeteria counters used at one time. Three meals per day were served Monday through Saturday, and breakfast and dinner were served on Sunday. The usual number served per meal varied from approximately 500 on Sunday morning to 1400 for a lunch or dinner meal during the week. Non-selective menus were served.

In addition to this main production and service unit a supplementary service was operated in another part of the building from two o'clock in the afternoon continuously to ten-thirty at night seven days a week.

There was one Administrative Dietitian, assisted by three full-time supervisors and one part-time supervisor. Twenty-seven full-time

food service employees each worked 40 hours per week. In addition approximately 145 student employees each worked fourteen hours per week. The work simplification program was designed for the full-time food service workers.

Conferences with Supervisors

Three conferences were held with the Administrative Dietitian and the supervisory staff before the introduction of the training program. The purposes of these conferences were to review work simplification generalizations, to develop interest in work simplification, to acquaint them with the tentative plans for the work simplification training program for workers, to secure their cooperation and their suggestions in regard to this program, and to instruct them in regard to the use of the rating scales to evaluate the workers.

During the first conference the purposes and expected outcomes of the work simplification program for workers were explained, and there was discussion among the group about the program. Colored slides No. 1 through 19¹ were shown to aid in the explanation of the procedures that would be used in the kitchen when analyzing work methods. The time schedule for the program was discussed to assure the best coordination with the work schedules of the food service unit. There was a brief discussion of work processes in the food service unit which the supervisors suggested were in need of improvement. A management text, which included a discussion of work simplification in food service,

¹A list of colored slides is in Appendix A.

was made available to each member of the group for reference.

At the second conference it was requested that the supervisors evaluate each employee on a rating sheet. The procedure to follow in checking the rating scales was explained. Half of the sheets were distributed since it was believed that more discriminating ratings would be made if only 13 or 14 workers were rated by a supervisor at one time. The sheets were so distributed, however, that during this first period of checking at least two supervisors rated each worker. The rating sheets, identified according to workers, were given to the supervisors to be filled in prior to the third conference. Following the explanation of the rating sheets two motion pictures were shown: "Improving the Job" and "Motion Study Principles."¹ A discussion of the films followed, and the group concluded that the two films were appropriate for inclusion in the training classes for workers.

At the third conference the rating sheets previously distributed to the supervisors were collected, and the remainder were distributed. These were collected from the supervisors within a week or two following this meeting. Final arrangements were made in regard to the time and place of the training meetings for workers. The major part of the conference period was used for consideration of work procedures or situations which according to the supervisors afforded the greatest opportunity for improvement. The discussion was initiated by the author, but interest developed until it was largely among the supervisors. Much of the discussion was concerned with the best method of locating service utensils used at the cafeteria counters and resulted

¹A list of motion pictures is in Appendix A.

in a proposed solution. It appeared to the author that by the end of this third conference there was increased interest among the supervisors in work simplification. In addition it seemed evident that they were willing to give complete cooperation and support to the proposed work simplification training program for workers.

No attempt was made to provide work simplification training for the supervisors in three conferences; this was not the objective of these conferences and was beyond the scope of the present study. The assumption was made that the purposes of the research as previously defined, could be achieved without encompassing supervisory training in work simplification.

Another conference was held with the supervisors after the sixth work simplification class for the workers. The purpose of this conference was to discuss some possibilities for work simplification which had developed as a result of the studies made of selected work processes and of discussions with the employees.

In addition to these four group meetings, there were frequent individual discussions with the Dietitian and the supervisors throughout the entire work simplification program; they cooperated throughout the program. A concerted effort was made when scheduling individual conferences and group meetings with employees and when working in the kitchen and dining rooms not to impede operations of the food service unit in any way. Special care was taken to discuss all of the proposals regarding work methods with the Dietitian before such changes were tried out in the unit.

Introduction of Program to Workers

It was considered desirable to meet with all of the food service workers and explain the proposed research program before any observations were made in the unit or before the individual interviews to administer the pre-test were begun. The objectives of this general meeting were to inform the workers of the plan of procedure, to indicate to the workers that the program was supported by the management, and to solicit their cooperation in the program.

The meeting, which lasted approximately 35 minutes, was arranged by the Dietitian. In order for all of the workers, except those who had that day off, to attend the meeting, the Dietitian remained in the kitchen during the meeting, but the food service supervisors and the Director of Residence attended. A brief condensation of the material covered is given in Appendix A. An attempt was made to emphasize the importance of the project.

The subject of work simplification was not definitely mentioned because it was not considered desirable to introduce the actual subject of the program until after records of work methods being used by the workers were secured and the pre-test was administered. It was difficult to introduce the program without actually telling specifically what the program was about. This situation exemplifies one of the major problems throughout the planning of the research project, that is, to set up research methods for collecting evidence to interpret outcomes concurrent with the procedures used in the training

program without having one significantly influence the other and without confusing the workers.

Administration of Tests to Employees and Collection of Additional Data

Individual conferences were held with the 27 full-time workers at the beginning of the program, one month after the training classes were completed, and approximately six months after the first interview. The purposes of these conferences were to administer the situation tests and to secure supplementary information from the workers.

The questions to be asked and the instructions given during the three series of interviews were written in advance and used as a guide for each interview. The formal interview was usually preceded by some conversation in order to put the employee at ease and to establish rapport. In addition there often was continued conversation following the interview. The introduction to each situation test is included in Appendix A. The motion picture, which presented the work situation for each test, was always shown twice. The length of the interviews was determined by the extent of responses to the situation tests, the questions asked by the author, and by the amount of conversation that preceded and followed the interview. The average time for the first interview was about 35 minutes. Time between interviews varied from 10 to 30 minutes. During this period the film was rewound, the tape on the tape recorder was changed when necessary,

and the next employee was contacted. The time spent for the second interview with a worker was usually less than for the first, and the third interview was the shortest of the three since only the situation tests were administered.

The responses received from the workers during the interviews were recorded in writing by the author. During the first two series of interviews the responses were also recorded on a tape recorder. Before the third series of interviews, the responses to the situation tests during the first two interviews had been transferred onto the score sheet and scored. It was decided not to use a tape recorder for the third interview, for it had been found that the written record had been sufficiently complete to score the responses.

For all three interview periods the order in which employees were interviewed was not predetermined; the chief determinant was whether a worker could conveniently leave the work he was doing when it was time for the next interview. An attempt was made, however, to see all of the workers from one work area before interviewing the workers in another area in order to lessen the opportunity for a worker to learn the nature of the conference before his interview.

Four days after the introduction of the program the first interviews with the workers were begun. Interviews were held with the 27 full-time employees over a period of four successive days. The first three days were during the period between winter and spring quarter classes. This period was selected because the workers were more readily available for conferences.

Certain personal data about the worker were secured and recorded on the personal data form, and the two situation tests were then administered. Following the tests, each worker was asked if there were any job that he did frequently that he would like to have studied to see if there were a better way to do it. He was also asked not to discuss the conference or motion pictures with the other workers until after every worker had had the same conference. The reason for this request was explained, and each worker agreed to the request. The same request was made at the end of the second and third interviews. It is the belief of the author that for the three series of conferences the workers cooperated and did not discuss the conference with workers who had not been interviewed.

The second series of interviews, which were held one month following the last training class, were scheduled on three days when the number of meals served was considerably reduced. Two of the 27 workers who had originally been interviewed were no longer employed in the food service; the total number of second interviews was therefore 25. After the two situation tests were administered, questions were asked to secure the workers' reactions to the work simplification program.

The third set of interviews was held at the beginning of the fall quarter before the regular number of meals was being served. All 25 of the workers who were interviewed for the second series participated in the third series of conferences. In addition, one of the workers who was not available at the time of the second conferences was interviewed. The two situation tests which were given during the first

interviews were administered again using the same procedure. The workers were instructed to give all of the suggestions they could think of to make the job easier, including those they might have given during the first interview plus any additional suggestions.

Work Simplification Classes

Seven classes were planned which were designed to implement the objectives for work simplification training for workers.¹ The specific objectives of particular classes were as follows:

<u>Classes</u>	<u>Objectives</u>
I	To help the worker recognize the need for simplifying work methods and motivate him to want to simplify work methods. ² To help the worker understand how work methods are studied in order to develop improved methods. ³
II and III	To help the worker learn how tools, equipment, and workplace affect the way he works.
IV and V	To help the worker learn how hand and body motions affect the way he works.
VI and VII	To help the worker learn how work process or sequence affects the way he works.

¹See objectives of work simplification training for employees in the Introduction.

²This was an objective for each subsequent class.

³This was also an objective for class II.

There was recognition in the planning of the classes that food service workers, such as the group for which these classes were planned, might not be interested in having their work methods simplified and improved. Even if individuals do not have particular interests, however, it is assumed possible to develop these interests (71). Some of the incentives for learning applicable to the individuals in this particular group include:

1. Pride in work and loyalty to the work group
2. A desire to be up to date, creative, efficient
3. A desire to improve themselves generally
4. Personal prestige
5. A desire to gain time and save work and discomfort in their personal life and/or in their job situation

Conversely, it was recognized that possible reasons for resistance to learning might be the desire to resist domination by others and to save themselves doubts and personal embarrassment. Both in the planning of the introduction of the program to the workers and in the development of the classes these factors were taken into consideration.

In the initial planning of the classes it became apparent that each class would have to be conducted twice in order for the employees on early and on late schedules to attend. Classes were planned for 11:30 in the morning and 1:30 in the afternoon on a given day. After class II had been repeated, it was realized that an additional repetition of each class would have to be arranged due to the fact that several employees could not attend all classes because their day off duty fell on the day of some of the classes. In order to have as

many employees as possible attend class II, it was held four times. Thereafter, each class was held three times instead of two times as originally planned. For example, one class was held twice on Tuesday and was repeated again on Wednesday morning; the next class was held on Wednesday afternoon and was repeated twice on Thursday.

Attendance was taken at each class by having the workers sign an attendance sheet. A total of 23 workers attended most of the classes. The first series of interviews had included 27 employees, but by the time the classes began one of these workers was no longer employed in the food service. Three other workers did not attend any of the classes, two because of absence due to illness and one because his regular work schedule did not include any of the hours when classes were scheduled. For various reasons some of the 23 workers who attended classes missed a class occasionally. The number attending each meeting is given below:

<u>Class</u>	<u>Number</u>
I	19
II	21
III	22
IV	22
V	22
VI	21
VII	22

The class meetings were 30 minutes in length and were held in a small dining room adjacent to one of the main dining rooms. The room

was in a convenient location in relation to the kitchen; the ventilation of the room was good; and the room was pleasant in appearance. During the classes the workers and the author were seated in comfortable chairs on three sides of two rectangular tables which had been placed together. The room had no outside windows and could be darkened completely. Equipment necessary for showing the motion pictures and colored slides could be left in this room between class periods.

Lists of the motion pictures and colored slides used in these classes and a copy of the illustrated training booklet developed for the classes, are included in Appendix A. The booklet provided a basic outline for the classes and was frequently referred to during the class presentations.

Class I¹

At the beginning of the class period the training booklet developed for use in the classes was distributed. Using the first pages of the booklet for illustration, the general plan of procedure for the seven classes was described, and the subject of work simplification was defined and illustrated in terms of how it applied to the group.

The black and white, sound, motion picture "Improving the Job" was introduced by explaining that this film would show how a worker in a factory and a worker in an office simplified the methods of doing their jobs, and that the same procedure might be used to simplify a food service job or a job in the home. Following the showing of the film, it was pointed out that the first step in finding a better method of doing a job is to study the method that is being used.

¹A condensation of additional information presented in this class is included in Appendix A.

A list of the work processes in the kitchen which the author had been studying was distributed. The workers were asked to make suggestions during the following classes in regard to how any of these or other work processes could be simplified or improved.

The only participation by the group was some comments by one worker in response to a question by the author. The workers appeared to be interested in the motion picture, but it might have been more effective for this class if the examples of methods improvement had been related to food service. Possibly the class would have been more effective in terms of the objectives if the class period had been long enough to allow more opportunity for discussion.

Class II

In this class the procedures followed to improve work methods were exemplified, and the way tools, equipment, and workplace affect work methods was considered. Colored slides No. 1 through 19 were shown to illustrate how a food service job, table setting, was improved. Workers were told that they would see first the original method and that each one should try to think of ways in which the job could be simplified. The work process was described as the slides depicting the original method were shown. Before the improved method was shown there was a limited exchange of ideas among the group regarding possible ways to improve the methods used. Then the improved method was explained as the corresponding slides were shown. Two of the slides depicted the routes of travel for the original and improved methods. Slides No. 17 and 18 were included

particularly to exemplify the procedure followed by an analyst in studying a job and developing an improved method.

Following the showing of slides No. 1 through 19, the guides to work simplification having to do with tools, equipment, and workplace were introduced. These guides were:

1. Use the available equipment that is best for the job
2. Keep tools, equipment, storage and workplace in good working order
3. Have equipment and supplies within easy reach at the place where they are used.

First the application of these guides given in the training booklet were considered. Then slides No. 20 through 40, which exemplified these guides, were shown and explained.

A description was given of the motion picture that would be shown in the next class in order to develop interest among the group and to relate to this film the work simplification guides which had been presented.

The booklet, Easy Ways (10), was distributed, but there was only time to comment briefly that the booklet was about ways to simplify homemaking tasks and that it would be of interest particularly to those in the group who were homemakers.

This class was held four times, and each time there was some oral response by the workers in regard to the work simplification guides and examples presented. By far the most discussion was among a group of four cooks who constituted the group for one meeting of this class. This group continued to make suggestions about the equipment and arrangement of equipment in the kitchen even after the time for the class had ended. One

worker noted a relationship between the table setting process depicted by the slides and a job which she performed. She stated that she could use some of the methods that were developed for the improved method.

There was reason to believe that the decision to consider the guides related to tools, equipment, and workplace first was a good one in order to stimulate discussion. There seemed to be little hesitance on the part of many of the workers to make suggestions in this area in relation to their work. The colored slides appeared to be viewed with interest. Additional time could have been used to advantage for more discussion by the workers.

Class III

The work simplification guides related to tools, equipment, and workplace were considered in this class by the showing of the color, sound, motion picture "Now I'm in Business." Before the film was shown, reference was made to the guides which had been presented in Class II, and the relationship between those guides and the motion picture to be shown was emphasized. It was stated that the picture depicted ways in which the right equipment helps in doing a good job of food production and service. The plot of the film was introduced briefly. The group was told that the film was made by an equipment manufacturing company to promote the sale of equipment and this fact needed to be remembered when viewing the film. The workers were asked to note particularly the type of equipment and how the equipment was located and used. They were also asked to see if they could note ways of improving some of the work methods. Following the showing of the film, the author emphasized some

of the points that were pertinent to work simplification.

When planning the classes, the use of this film was seriously questioned because the running time was 26 minutes, and because the relationship between much of the content of the film and the subject of work simplification was not always apparent. The decision to include the film was based on the fact that the film did emphasize the importance of equipment and layout to efficient food service operation and in addition showed various food service situations which could engender interest and pride in food service work. On the basis of the use of the film in this class, the author would recommend that it not be included in a series of work simplification classes unless the class periods were longer than 30 minutes. There were a few comments by the workers in regard to certain pieces of equipment or the methods used, but there was insufficient time to relate the film to the topic of work simplification. Comments of the workers indicated that they enjoyed seeing the film, but there was little evidence of any other outcomes.

Class IV

Most of the time in this fourth class was devoted to a consideration of how hand and body motions were related to work simplification. First, however, reference was made to the training booklet, and there was a review of the work simplification guides related to the tools, equipment, and workplace. The group was asked to give additional examples of how these guides could be applied to some of the work done in their jobs. The author also gave examples, and made reference to some

of the points in the motion picture shown in the preceding class.

The guides to work simplification concerned with hand and body motions were then introduced. These included:

1. Let both hands do useful work at the same time, when possible
2. Perform work in a rhythmic way - use smooth continuous curved motions
3. Use the fewest, shortest, and simplest motions
4. Maintain a comfortable working position, and bring the work you are doing right in front of you if possible.

Attention was directed to these guides as they were listed in the training booklet and to the corresponding examples illustrated. The workers were asked for other examples of ways in which their work might be simplified by changing hand and body motions. Next colored slides No. 41 through 57 were shown and discussed.

Some introduction was made of the motion picture which was to be shown in the next class, and the relation between the above guides and the film was noted.

There was more time for discussion among the workers in this class than in any of the previous classes, and in all three sessions of this class there was considerable participation. Many of the comments were related to tools, equipment, and workplace; however, several suggestions were made in regard to hand and body motions. Two of the workers stated specifically that they could not work with two hands at the same time. Frequently a situation presented in one of the colored slides would stimulate some discussion during the showing of these slides.

Class V

The black and white, sound, motion picture "Motion Study Principles" was used in this class to continue the consideration of hand and body motions. It was explained that although this film was about work situations in industry, many of the principles demonstrated could be applied in food service work. The content of the film was related to the guides discussed in the previous class. The workers were asked to think of ways, as the motion picture was being shown, that the principles presented could be applied to their work. It was suggested that they write these ideas in their booklet and bring them to the next class.

In one of the sessions of this class, there was no time for comments after the showing of the picture due to some mechanical difficulty with the projector at the beginning of the session. In the other two sessions there were limited comments.

In the original plan for the classes, the use of this film was not included because its running time was 28 minutes and because all of the examples were related to industry. It was shown to the supervisors, and on the basis of their recommendations the decision was made to include it in the classes for workers. The excellent interpretation of motion study principles in this film seemed to warrant its inclusion even though the length of the film did not permit discussion and the examples were not related to food service.

Class VI

The work simplification guides related to work process or sequence

were considered in this class. At the beginning there was some discussion relative to the motion picture shown in the previous class. Then, referring to the training booklet, the following guides to work simplification were introduced:

1. Arrange work areas to eliminate unnecessary walking or reaching
2. Eliminate or combine parts of a job, if possible
3. Plan the order and time of work for best results
4. Standardize procedures to eliminate need for repeated decisions

The color, sound, motion picture "Skill Counts at the Sandwich Counter" was explained briefly and then shown to the group. Following the viewing of the film there was some discussion of it in relation to the procedures which were used by the cooks in making sandwiches. Colored slides No. 58 through 67 were then shown and discussed. When an inefficient method was shown, workers were asked to make suggestions for improvement. They would often suggest the improved method which was later shown on the next slide. There was considerable discussion related to slides No. 61 and 62 which depicted flow diagrams of routes of travel followed by a worker when making a cake using an original and an improved method.

A notable amount of participation by the workers was obtained in two sessions of this class. As in the case of other classes there was much less discussion among the largest group which met after the lunch period and included most of the men workers. The word sequence in the

training booklet was not clear to some of the workers; the word order was suggested as an alternative. The film "Skill Counts at the Sandwich Counter" was excellent in that it demonstrated many of the work simplification guides as applied to the job of making sandwiches. Some of the specific techniques were not applicable, however, to the sandwich making process actually used by the cooks in the class. The workers appeared to be interested in the colored slides shown; the technique of using the slides in stimulating participation of the group seemed to be successful.

Class VII

In this class ways in which work process or sequence affects work methods were further considered, application of all of the work simplification guides were reviewed, and plans for the remainder of the research program were presented. The color, sound, motion picture "Damp Dusting" was introduced. Certain sections of the class were asked to watch for examples in the film of one of the following:

1. How the use of the correct tools or equipment helped to improve the method of work
2. How the work was simplified by simplifying hand and body motions
3. How the work was simplified by planning the best sequence in advance.

After the showing of the film, various members of the group reported on the above points. During the discussion too, the idea was developed

that the method used for any one job must be determined to some extent by its effect on other work situations with which the job is related; specific examples were given as illustrations. At the conclusion of the class the purposes of the classes were summarized, and the workers were informed of the plans related to the research program. It was explained that during the next three to four weeks the author would be working in the kitchen and dining room to help work out some possible ways of simplifying methods for a few selected work processes which had been studied before the classes began. The workers were urged to make any suggestions, during this period, which they might have for simplifying or improving the jobs being studied. They were also told that at the end of this period of three or four weeks, the author would again have interviews with each person as she had at the beginning of the program.

A black and white, silent, motion picture "Damp Sweeping" was sent with the film ordered for this class. Although this film had been previewed it had not been planned to use it. Since the film was available, however, and because there had been very little about cleaning methods in the classes, the film was shown to five of the men workers who had responsibilities for care of the floors.

Although the film "Damp Dusting" was not related to food service, it was apparently an appropriate film for the last class period, for many of the work simplification guides considered in previous classes were exemplified in this motion picture. The technique of assigning various members of the group a specific point to watch for during the viewing of the film seemed to be a good one to promote group participa-

tion. In two sessions of the class which had only six and three members there was considerable discussion of pertinent points. In the larger group of 13, which included all of the men workers, there was very limited participation. Some of the unsolicited remarks made in the smaller groups indicated a sympathetic understanding of management problems in operating the food service and a positive and cooperative attitude toward working out some of the problems in regard to work processes which were known to exist.

Work Processes Studied

The study of selected work processes was an integral part of the work simplification program. The purposes served by this phase of the program were as follows:

1. To select appropriate illustrations for use in the training classes, observations were made of the work methods being used.
2. To provide on-the-job examples of how a process could be improved by the application of work simplification generalizations, analyses were made of selected work processes.
3. To provide an opportunity to determine the workers' reactions to having their work methods studied, the extent to which they would make suggestions for improving work methods, and whether they would adopt and use new work methods proposed, work methods were analyzed and new methods were introduced.

There were two periods of observation and study in the food service unit; each period consisted of selected intervals over approximately one month of time. The first period preceded the work simplification classes, and the second period followed the classes. Studies and additional observations in the food service were limited to the main food service unit.

At the beginning of the first period, observations were made throughout the main food service unit in order to become acquainted with the general organization of work. Various factors influenced the selection of work processes to be studied as a basis for developing improved methods. Since the analyses of the work methods were made by only one person, detailed analyses of hand and body motions could be made for jobs or portions of jobs for only one worker at a time. This fact presented some limitations, for many of the work processes in the kitchen were performed cooperatively by two or more workers at one time. In general, jobs were selected which were performed relatively frequently. A process might be selected for study if either the supervisors or workers indicated dissatisfaction with the methods used, or if there were some apparent opportunity for improvement of the method.

During this first period many different work processes were observed and recorded. Each step of the work process was recorded. A clip board and a decimal minute stop watch were used. The type of analyses made is evidenced by the subsequent reports of work processes studied.

In the second period of observation and study in the food service unit, improved methods were considered for eight of the processes studied during the first period. These work processes are classified below accord-

ing to the place in which the job was performed:

Kitchen, general

Cutting grapefruit in half

Salad unit

Slicing peeled oranges

Coring and cutting tomatoes for tossed salad

Vegetable preparation unit

Machine peeling and hand finishing potatoes

Cooking unit

Dicing cooked potatoes for hashed brown potatoes

Making ham salad sandwiches

Dessert unit

Transporting equipment and supplies

Dining room

Inspecting and setting up dining room tables

In some instances, the author developed the improved methods on the basis of analysis of the original methods used, whereas for some other processes the improved methods were worked out with the workers. An improved method was not developed for machine peeling and hand finishing potatoes because the analyses of the original method indicated a need for major revision of the equipment in order to make appreciable improvement in the method used. For two processes, namely, making ham salad sandwiches and transporting equipment and supplies, some suggestions were given for improving the procedures, but an improved method was not effectuated. Improved methods were developed for five of the eight

processes. The original and improved methods, as presented in the subsequent descriptions, were based on actual observations of a cycle of the work as it was done by the worker on two or more occasions.

Cutting grapefruit in half

The grapefruit for breakfast were prepared the previous afternoon. One of the men employees placed the boxes of grapefruit on the counter for the woman employee who cut the grapefruit. After the grapefruit were cut and placed in pans they were taken to the walk-in refrigerators where they were stored until the next morning. The comparison between the original and improved method for cutting grapefruit is made on the basis of the number of grapefruit cut in a specified period of time. The method used in both the original and improved method was affected by the fact that the employee was left handed.

Original method. Operation Sheet No. I for the original method is in Appendix B, and the workplace layout is shown in Figure 7. The box of grapefruit was arranged on the employee's right with the open side at the top. The board on which the grapefruit were cut was in front of the employee, and the pan for the cut grapefruit was to the left. The cart on which the pans of cut grapefruit were placed was also to the left. The employee took the grapefruit with her right hand, cut with her left hand while she held it with her right, and placed it in the pan to her left with her right hand. This last movement necessitated crossing the right hand over the left hand which was holding the knife. The grapefruit was never released by the right hand during the process. The blade of the

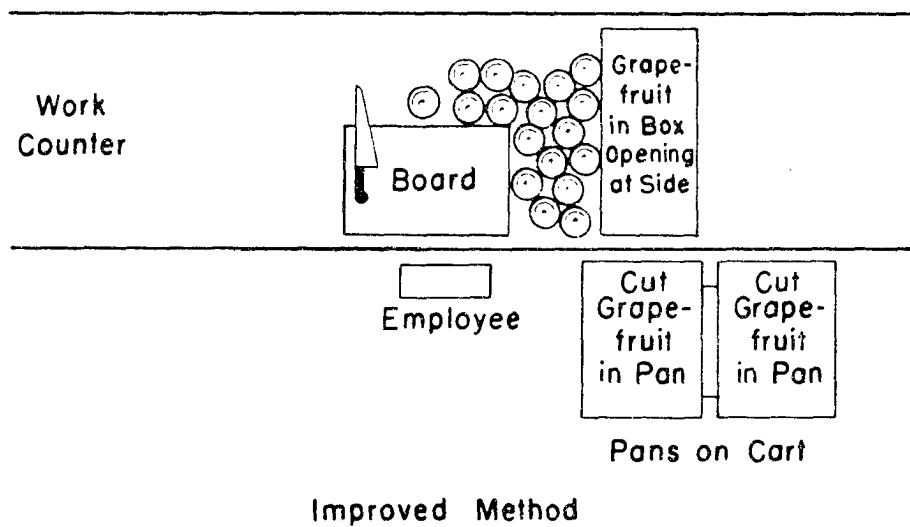
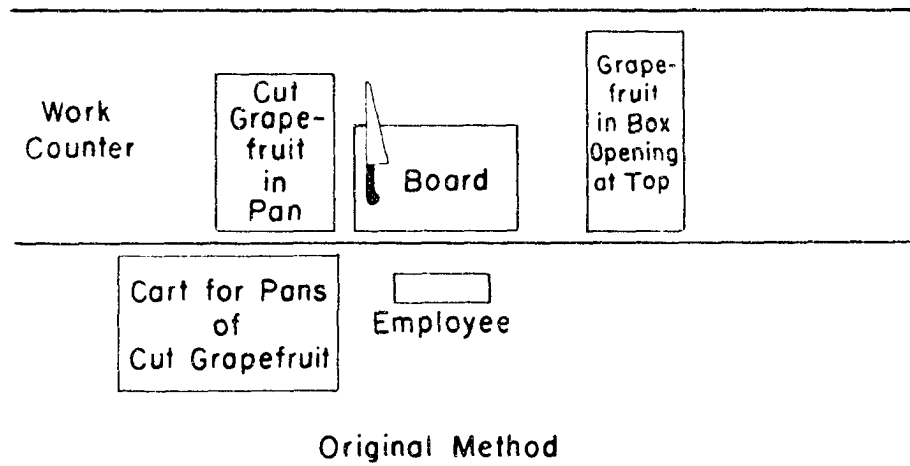


Fig.7. Workplace Layouts, Cutting Grapefruit in Half
(Left Handed Employee)

French knife used was badly worn and was not as sharp as desirable.

Improved method. The following changes were incorporated in the improved method:

1. The box of grapefruit was turned on the side, with the attached top bent back over the upper side, so that the grapefruit rolled out onto the table near the work area.
2. The pan for the cut grapefruit was placed on the cart to the employee's right.
3. A sharper knife was used.

A description of the improved method is given in Appendix B, Operation Sheet No. II, and the revised workplace layout is shown in Figure 7.

Alternative changes were possible, but the changes indicated above seemed the most desirable at this particular time and location. The same sequence of activities was followed in the improved as in the original method.

Discussion. There was no decrease in the number of activities per grapefruit, but the lengths of one reach and one move were decreased considerably by the improved method. With the pan of cut grapefruit adjacent to the box of grapefruit, the reach to secure the grapefruit was much shorter. Having the box turned on the side allowed the grapefruit to roll out onto the table and therefore required a shorter move to the board. It was not necessary to raise the hand above the height of the box to reach for the grapefruit and to bring the grapefruit to the board, as in the original method. The last grapefruit remaining in the box could be pulled closer to the work area at one time. The move from the board to the pan was about the same distance. By placing the pan for the grapefruit on the

cart it was not necessary for the woman employee, who was relatively short, to lift the pan of grapefruit from the 34 inch high table and transfer it to the cart. A one-inch ledge at the edge of the counter did not permit pulling the pan onto the cart directly. The sharp French knife made the cutting process easier. The main advantage of the improved method was to make the work easier.

There was, in addition, some advantage from the standpoint of rate of productivity. Using the original method an average of about 17 grapefruit were cut in a two-minute period; whereas, using the improved method an average of about 18 were cut in the same length of time. This represents a decrease in time per grapefruit of approximately 5 per cent.

The changes incorporated in the improved method represented a composite of influences. It was known to the author that when one of the supervisors was performing this job she turned the box of grapefruit on the side so that it would be easier to secure the grapefruit from the box; therefore, the employee had seen this arrangement used. Subsequent to the work simplification meetings (but before the author worked with the employee on the improved method), the employee was observed when she had placed the box with the opening on the side; however, it was located on the left of the board. It is not known whether the worker had changed the position of the box as a result of a suggestion made in a work simplification meeting or because of directions from the supervisor. On the first day the author was to work with the employee in the use of an improved method, the same supervisor gave special attention to see that the worker was provided with a French knife that was sharp and in good condition. In arranging the workplace layout, the employee of her own accord

placed the pans for the cut grapefruit on the cart. During the work process the employee shoved the filled pan to the back of the cart, and placed an empty one in position near her.

The worker initiated some of the innovations and accepted those suggested. The two times the improved method was tried she commented that it was much easier. It was not feasible within the limits of this study to determine if the employee would regularly use this method. It was of interest to note that immediately after the first time the employee was instructed in the use of the improved workplace layout, she continued to use a layout for portioning jam into bowls which necessitated the same type of crossing over the work area as was noted in the original method of cutting grapefruit. She was willing, however, to revise this layout for portioning jam when the suggestion was made that she do so.

Slicing peeled oranges

Sliced oranges were frequently prepared for fruit salad. Medium size Navel oranges were used. Before peeling, they were first soaked in hot water for about ten minutes. To peel them both ends of the peel were sliced off with a knife, and one cut was made down the side of the orange; then the peeling was pulled or stripped from the orange in one or two pieces. After being peeled, they were placed in a pan, covered with a damp cloth, and stored in the refrigerator until chilled.

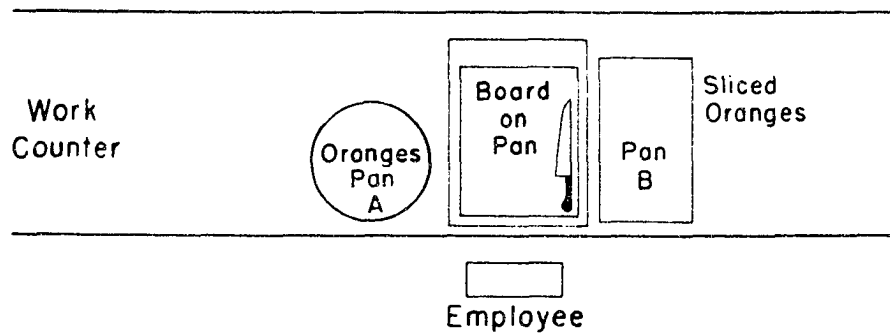
There were two full-time employees in the salad unit. The comparison of the original and improved method was made on the basis of work done by worker No. 2.

Original method. Operation Sheet No. III for the original method used to slice the peeled oranges is in Appendix B. The workplace layout is given in Figure 8. In the original method oranges were transferred, by the left hand two or three at a time, from pan A to the slicing board until 12 to 15 oranges were on the board. By slicing four times with a French knife the oranges were cut into five slices. Then the slices were grasped from the board with the left hand and transferred to pan B. The round pan A on the left which contained the oranges was five inches deep. The board on which the oranges were sliced was placed in a large bun pan to collect any juice. The rectangular pan B for the sliced oranges was to the right.

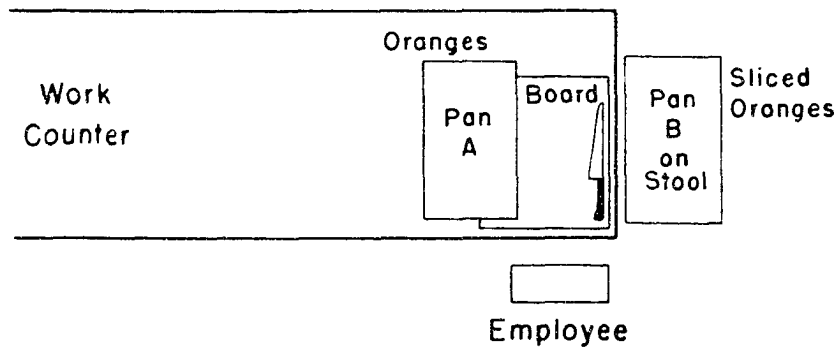
Improved method. Two innovations were put into effect in the improved method.

1. One handling of the oranges was eliminated by using a shallow rectangular pan for the whole oranges and moving it closer to the work area.
2. Drop delivery was used to transfer the sliced oranges to the second pan.

The improved method is charted on Operation Sheet No. IV in Appendix B, and the workplace layout for the improved method is shown in Figure 8. The worker herself eliminated the use of the pan below the board, for there was little juice on the board during the cutting process. A shallow rectangular pan was used for the whole oranges, and the worker was directed to bring the pan as close to the board as possible. She devised the plan of actually placing the pan on one side of the board rather than adjacent



Original Method



Improved Method

Fig.8. Workplace Layouts, Slicing Peeled Oranges

to it. An orange was then transported directly to a position for slicing. A rectangular pan was placed on a stool at the end of the work counter at the worker's right. To transfer the sliced oranges to this pan, the worker scraped the orange slices off the board into the pan with the blade of the cutting knife. A comparison of the results of the original and improved methods is shown in Table 2.

Table 2. Slicing twelve peeled oranges, comparison of original and improved methods

Activities	Original method	Improved method	Saved
Left hand			
Operations	58	24	34
Transportations	22	24	- 2
Delays	0	0	0
Right hand			
Operations	12	12	0
Transportations	0	12	-12
Delays	68	24	44
Time - minutes	1.62	1.45	.17

Discussion. The improved method decreased the total number of activities from 160 to 96 and decreased the time by approximately 10 per cent. The worker in charge of the salad unit stated that she had used the method of drop delivery in some work processes before, but had not been using it recently since there was not always a stool available to use for holding the pan. (At the time of this study a stool was available in the adjacent

work unit.)¹ Both employees in this unit accepted and used the improved method during the period of the research program.

The considerations in this study as well as in other studies point up the advantage of rectangular pans over round when arranging a compact workplace layout. Pans of other shapes were not considered in this study.

During the process of developing the improved method, an attempt was made to slice the oranges on a machine used for chopping and cutting vegetables. On the particular machine available the method was not successful; the oranges were mashed rather than sliced.

Coring and cutting tomatoes for tossed salad

Small pieces of tomato were included as one of the ingredients in the tossed salad. These were prepared immediately before the ingredients for the salad were combined. The comparison of the original and improved method was made on the basis of work done by worker No. 2 in the salad unit.

Original method. Operation Sheet No. V for the original method is in Appendix B. The workplace layout is given in Figure 9. The tomatoes were in a pan A which contained water and was placed to the left of the cutting board. Using a paring knife, the stem and bloom ends of the tomatoes were cut out and dropped into pan A, and the tomatoes were placed on the board. This process was continued for 10 to 15 tomatoes. Then the employee transferred her position so that she was in front of the board, and the tomatoes were cut into small pieces using a French knife. Holding the

¹A small, low, movable stand could have been used to advantage in this department for other work processes as well as for the process considered in the present study.

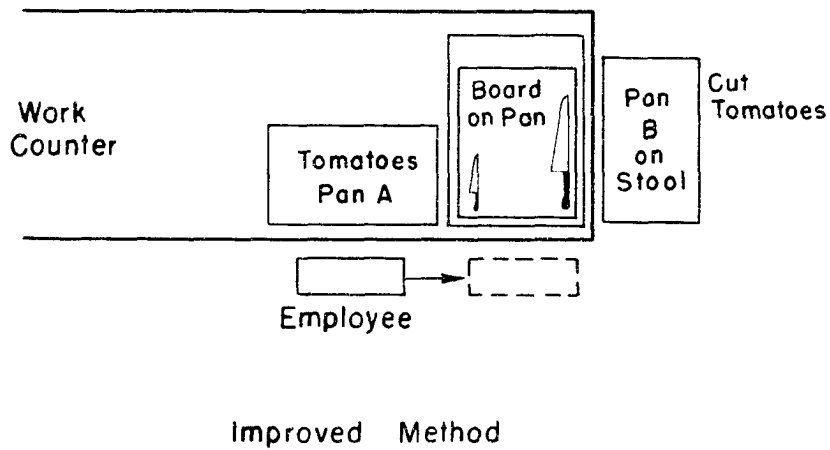
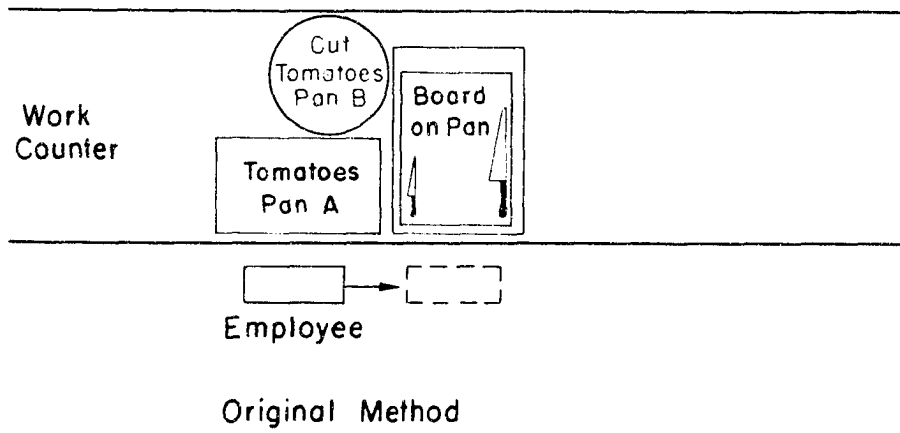


Fig.9 Workplace Layouts, Coring and Cutting Tomatoes for Tossed Salad

tomato with the left hand, it was sliced, and, then by cutting perpendicular to the slices, it was cut into small pieces. Two methods were used to transfer the pieces to pan B at the top left of the board. One was to push the pieces onto the blade of the knife and transfer them to the pan. If the tomatoes were large, the amount of tomato was too great to transfer on the blade of the knife; therefore, the knife was released and the two hands were used to scoop up the tomato pieces and transfer them to the pan.

Improved method. The innovation introduced in the improved method was to use drop delivery to transfer the pieces of tomatoes to the pan. The improved method is described on Operation Sheet No. VI in Appendix B, and the diagram of the workplace layout is shown in Figure 9. The board used was placed at the end of the work counter, and a rectangular pan was placed on a stool by the end of the counter. After the tomatoes were cut into pieces, they were scraped off the board with the blade of the knife and dropped into the pan at the lower level.

Discussion. The one change in procedure resulted in a 45 per cent decrease in time as well as a decrease in the number of activities. The comparison of the two methods is shown in Table 3. The improved method was accepted and used by both of the employees in the unit during the times observed throughout the remainder of the research program. Another possible improvement in the over-all process would have been to wash the tomatoes in a pan at the sink and let them drain in a colander before bringing to the work counter. This aspect of the process was not considered in the present analysis, however, since use of the sink area by another worker was sometimes encountered.

Table 3. Coring and cutting twelve tomatoes for tossed salad, comparison of original and improved methods

Activities	Original method	Improved method	Saved
Left hand			
Operations	108	96	12
Transportations	72	60	12
Delays	6	0	6
Right hand			
Operations	84	61	23
Transportations	66	60	6
Delays	36	35	1
Time - minutes	7.08	3.88	3.20

Machine peeling and hand finishing potatoes

During the period of the present research an average of 500 to 600 pounds of potatoes was used per day. All of these potatoes were peeled except once when baked potatoes were served. One full-time worker was responsible for peeling and hand finishing the potatoes. She was assisted by boys, student employees, who were scheduled to this work for different lengths of time varying from a few minutes (when a student worker had completed his regularly assigned job) to 3.25 hours. During a one-week period as many as 15 to 20 students may have helped peel and finish potatoes. If other full-time kitchen employees had available time, they helped with the hand finishing of potatoes, but the proportion of time that these full-time employees applied to this work was very small. The number of employees working at this process at one time varied from one to six.

Original method. The layout of the work area for peeling and finishing potatoes is shown in Figure 10. This layout was a commonly used one when three people were working at the job. The arrangement of the pans and galvanized cans varied from one work period to the other depending on a variety of factors. Usually 10 to 13 bags of potatoes were delivered to the vegetable unit from the storeroom at one time. The 100 pound bags were delivered on a skid, which was left in the location indicated in Figure 10. When three different people were working at this job, as depicted in Figure 10, employees No. 2 and No. 3 hand finished potatoes, and employee No. 1 ran the potatoes through the peeler and kept the two other workers supplied with potatoes. Employee No. 1 also finished potatoes, using the table as a workplace. The two galvanized cans for finished potatoes were located on a dolly.

A general description of the work process follows:

Employee No. 1, who during times of observation was a male student worker, cut the string on a bag of potatoes on top of the pile and dumped them into a pail until it was filled level with the top. The pail was then carried to the potato peeler, lifted to the top of the peeler, and the contents dumped into it. While the machine was running, the next pail of potatoes was secured. Five separate machine operations were usually made for each 100-pound bag of potatoes.¹ When time studies were being made, the machine running time varied from 1.30 to 2.30 minutes with a mean of 1.66. After a load of the potatoes was run, the front of the machine was opened, and the potatoes were allowed to fall into a pan in the bottom of the adjacent sink. After two or three machine loads of potatoes were emptied into the pan, it was filled or refilled with water, lifted, and carried to the sink counter or table to be eyed. The weight of the pan filled with potatoes and water ranged from 50 to 60 pounds.

¹It was important for most effective operation that the quantity of potatoes per machine load not be excessive. The quantity of potatoes which was specified per machine load was one pail filled to level capacity.

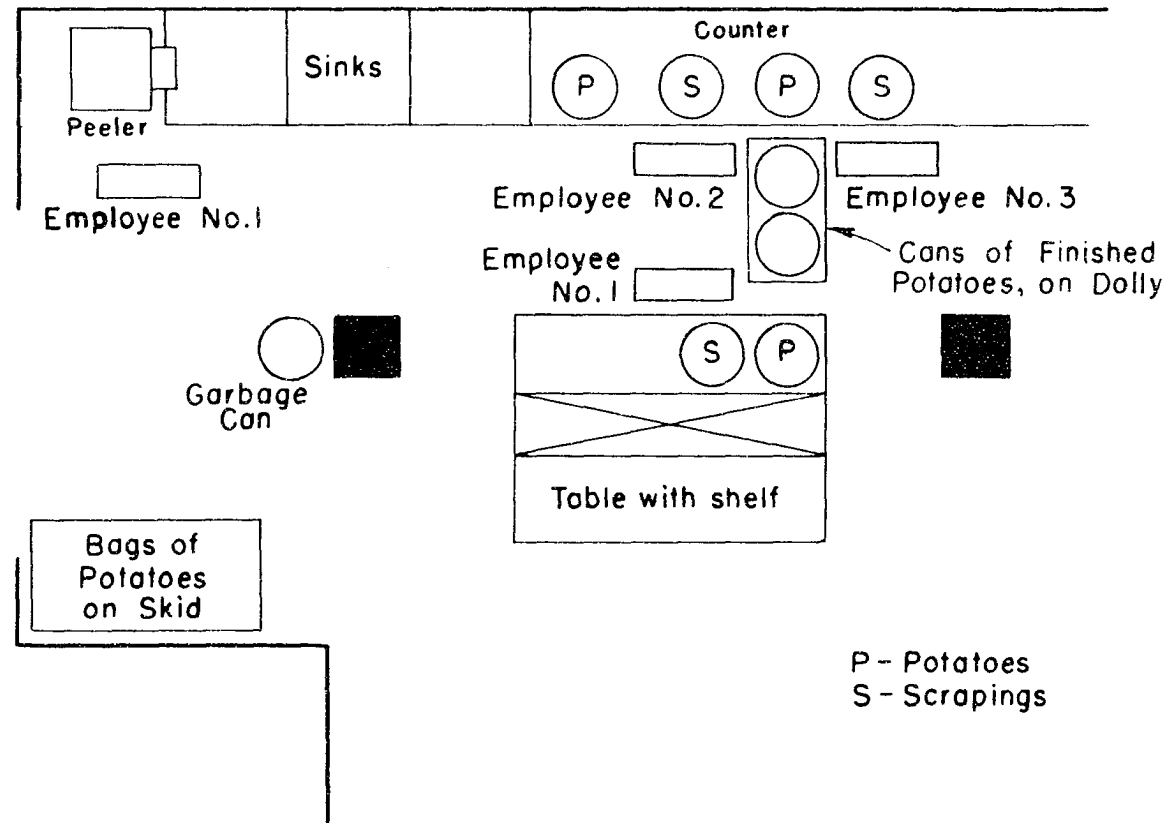


Fig. 10. Workplace Layout, Machine Peeling and Hand Finishing Potatoes

The handwork process followed by employees No. 2 and No. 3 was to reach for a potato and bring it to position for the hand operation; scrape off or cut out any remaining potato skin, eyes, or blemishes; and drop the finished potato into a galvanized can partially filled with water. The hand equipment used was a vegetable peeler, with a double internal edge, of the type used with an oscillating motion. The end of the peeler was sometimes used to remove the eyes of the potato, but most of the finishing process was done by scraping. The direction of the scraping process was away from the body, and the scrapings fell in front of the scraping operation. Assuming that both workers were right handed and the layout shown in Figure 10 was used, the work movements for employees No. 2 and No. 3 were of necessity different.

The two galvanized cans, on a dolly, were rolled into the walk-in refrigerator when filled with potatoes. The pans of scrapings were emptied into a colander in the sink to drain, and finally the colander was emptied into the garbage can in front of the sink. During the scraping and eyeing process, the workers sometimes stood and sometimes sat on high stools.

Based on the five time studies that were made on two different days, an average of 71.36 minutes labor time¹ was used to peel and finish a 100-pound bag of potatoes. This time included, in addition to the work processes described above, time to secure needed equipment, fill the galvanized cans with water, and wait time for worker No. 1 during the running of the machine. It did not include, however, any portion of the time needed to clean the potato peeler, sink, and work counter after all of the peeling was completed. About 75 per cent of the labor time was used for the hand finishing of the potatoes. The data from three yield studies are shown in Table 4. These three studies were made in one day from the same lot of potatoes.

¹This time was based on the work time of the full-time employee assisted by one or two students. If student workers not supervised by a full-time employee did not work as steadily as workers who were supervised, the labor time per bag of potatoes would be greater. If student workers when not supervised, ran the potatoes in the machine for a longer period of time than prescribed in order to decrease the amount of work involved in finishing the potatoes, there would be a decrease in the total amount of labor time, but it would also decrease the E.P. yield of potatoes.

Table 4. Yields of potatoes after machine peeling and hand finishing

Net weight A.P. (pounds)	Yield			
	After machine peeling		After hand finishing	
	(pounds)	(per cent)	(pounds)	(per cent)
98.8	77.5	78.9	71.2	72.5
98.8	80.8	82.2	74.0	75.3
101.8	80.2	79.3	75.0	74.1

Discussion. Upon analysis of the work process it became apparent that there were many ways in which the work methods might be improved. The methods used by the full-time employee for finishing the potatoes were used as a basis for evaluation for two reasons: one, the present research was concerned with full-time employees; and two, the student employees did not work as efficiently as the full-time worker, and it was desirable to study the most efficient method used. Some of the aspects of the work process which needed to be considered included the following:

1. Pails of potatoes were being carried approximately 8 feet from the bags of potatoes to the machine.
2. Pails of potatoes, which weighed approximately 20 pounds, were lifted to a height of 53 inches to be dumped into the machine.
3. Pans of potatoes weighing between 50 and 60 pounds were being lifted from a height of 28 inches to a height of 42 inches and

then were carried a distance varying from 8 to 12 feet. (Pans of potatoes were filled with water before they were carried to the work area for the hand finishing.)

4. There was no device on or near the peeler for timing the length of the machine operation.
5. When hand finishing a potato, the length of the move of the potato from the pan to position in front of the worker was about 20 to 25 inches. Likewise the move of the finished potato to the galvanized can was about the same distance, as was also the following reach to the next potato.
6. The number of scrapes or cuts seemed to be excessive. The number per potato for 45 potatoes varied from 2 to 38, as shown below:

No. of scrapes	No. of potatoes
1-10	7
11-20	20
21-30	15
31-40	3

7. The size of potatoes run through the peeler at one time varied considerably. Sample weights were taken on two occasions, and the range in weight of potatoes varied the first time from 3 to 12 ounces and another time from 4 to 22 ounces.
8. The scrapings were handled twice, once to the sink to be drained and then to the garbage can. The colander used for draining the scrapings sometimes had to be secured from the opposite end of the kitchen.

9. By having two galvanized cans on one dolly, the dolly blocked the traffic between the counter and the table. In addition when both cans were filled with potatoes and water it was difficult to move the dolly.
10. It was not possible to sit in a comfortable position at the table because of a shelf below the work counter.

Some minor simplifications would have been possible within the limits of the present facilities, such as moving the containers of unfinished and finished potatoes nearer the worker, but it was apparent that any significant improvement necessitated major decisions by management. The author conferred with the Dietitian and her supervisory staff. Two different types of changes in facilities were discussed: one, remodeling of the present equipment, and two, the use of an entirely new layout. Since this was a new kitchen, it was not expected that the Dietitian would be interested in following through on the latter proposal. When the various possibilities were presented, however, she was willing to completely revamp the layout if there was evidence that the efficiency of the entire process could be materially increased. Before making a major change of this type considerable study, experimentation, and planning would be advisable. Some aspects to be considered included:

1. Should potatoes be peeled, or should processed potatoes be purchased? In addition to the consideration of quality and cost, the need for providing work for students might be a consideration.
2. Should the potatoes for all of the food service units in the

residence halls on campus be peeled in this kitchen?

3. Should potatoes be sorted according to size before peeling?

If so, where could this be done? Could potatoes be purchased that were within a certain size range? Should potatoes of better quality be purchased? What variety would be best.

4. What would be the best type of equipment and layout for peeling potatoes? What would be the relative advantage of these facilities over the present facilities? How long would it take to pay for the new installation on the basis of the savings derived? Could the present equipment be used in a future installation?

Although some information had been collected which provided a limited basis for decision, it became obvious that a thorough analysis of the factors could not be included within the scope of the present research. In so far as making a comparison of the relative efficiency of proposed facilities with the present facilities, this could be done by analyzing the two work processes and applying predetermined times.

The author made some suggestions relative to the design of equipment. Pertinent references were also cited (1, 19, 23, 29, 49, 55, 62, 63), but there were no other steps taken during the process of the present research toward effectuating improvements in the process of peeling potatoes. In view of the interest evidenced by the Dietitian in the proposals made, it is expected that further consideration will be given to the problem.

The developments of this work process study have been presented in some detail for two reasons: one, to exemplify the course of events that

sometimes follows a study of work methods, and two, to provide a basis for further study of this work process both in the food service in which the present research was conducted and in other food service units. In every quantity food service operation decisions must be made relative to processing potatoes. Further research in this area would be of value.

The full-time employee and the student employees cooperated completely in all of the analyses made in relation to the study of this process.

Dicing cooked potatoes for hashed brown potatoes

In the preliminary conferences with the Dietitian the question was raised of whether there were any work processes which were particularly in need of study and improvement. The process which was considered to be especially time consuming was that of dicing cooked potatoes for hashed brown potatoes. She stated that a way had not been found for simplifying this process and maintaining the quality of product desired. It was the general opinion of the cooks and of the supervisory staff that it was not possible to modify the method used without sacrificing the quality of the final product. Two electric cutters used in the kitchen had been tried for cutting the potatoes, and had not been found satisfactory.

Because the process was so time consuming the item could only be included on the menu occasionally even though it was popular. The peeled potatoes were usually cooked one day in advance and then cut on the day they were browned; however, it was often necessary to begin cutting some of the potatoes a day in advance in order to get all of them cut.

It was preferred for both the original and improved method that the

potatoes not be halved or quartered before they were steamed. If some of the potatoes were excessively large, however, they were cut to equalize the cooking time needed for potatoes in the same steamer basket.

Original method. In general the method used was to take one potato at a time into the hand and cut it with a paring knife into cubes or pieces of approximately the same size. The potatoes were first sliced down lengthwise in two directions, using the palm of the hand or the fingers and thumb as a base. Then the potatoes were sliced across against the thumb or the side of the hand.

The specific method used by employee No. 1 to cut the cooked potatoes is described on Operation Sheet No. VII in Appendix B. The three workplace layouts used are shown in Figure 11. Following is a description of the over-all methods of procedure for the five time studies reported in Table 5.

Study
No.

1. Layout A was used during the first 5 minutes. Potatoes were taken one by one from the steamer basket on the left. At 5.00 minutes, when another employee began to work at the same job, layout B was adopted by moving the steamer basket to the right, and then potatoes were taken one at a time from it. At 6.60 minutes the procedure was varied in that five to eight potatoes were taken from the steamer basket at one time and placed in the pan into which the diced potatoes dropped as they were cut. Then each potato was taken from the pan and brought into position to cut. Employees talked as they worked.
2. Layout B was used, and the same procedure was followed as described above for this layout. Employees talked as they worked.
3. Layout C was used. Employee sat on stool in front of the counter and placed pan in her lap. (Employee's knees could not extend under work surface because of closed cupboard below.) About 25 potatoes were transferred at one time from

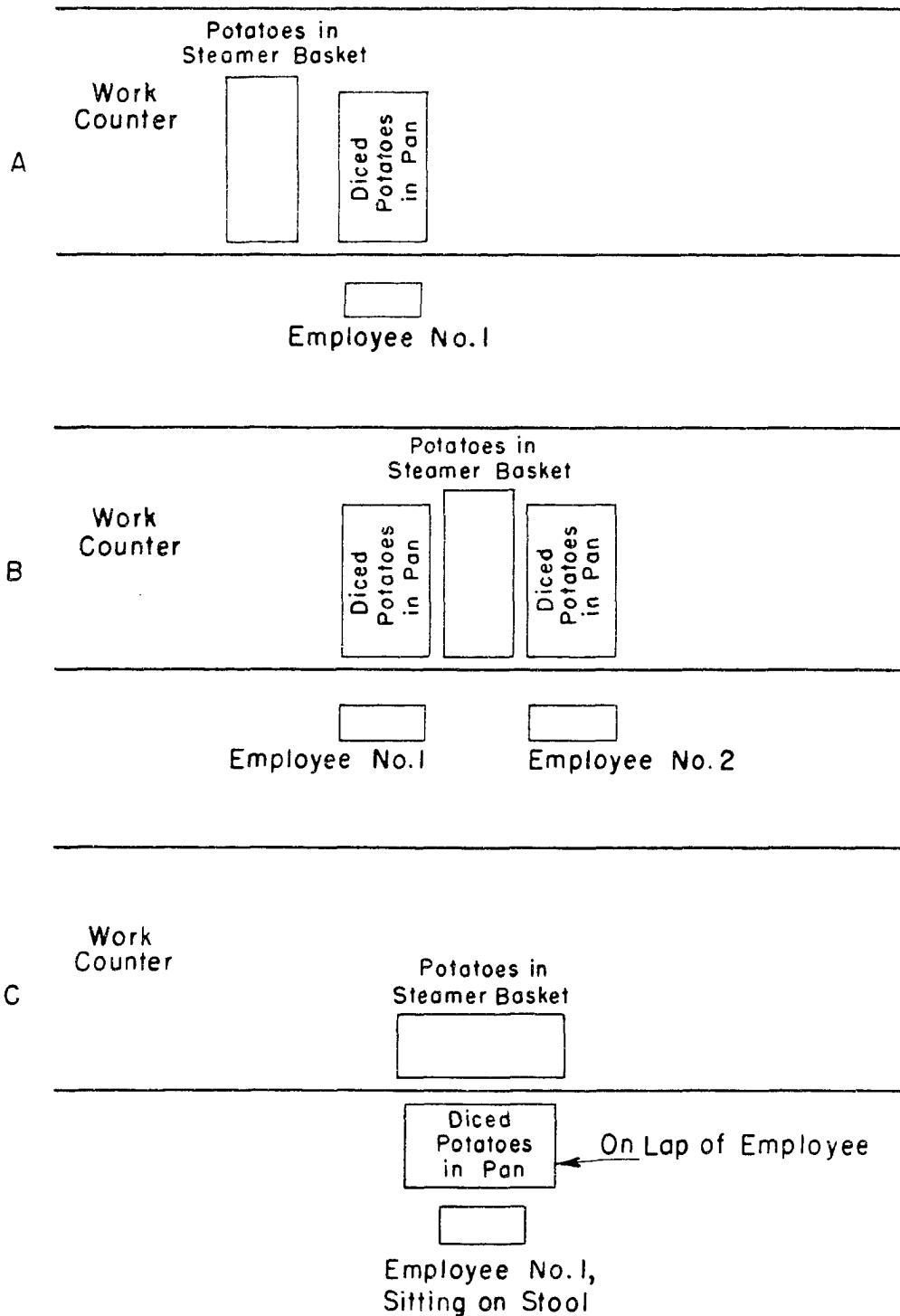


Fig. 11. Workplace Layouts, Dicing Cooked Potatoes for Hashed Brown Potatoes, Original Method

the steamer basket on the counter top to the pan in the worker's lap. Then each potato was taken from the pan as it was grasped and brought into position to cut. Worked alone.

4. Same as study No. 3.

5. Same as study No. 2.

Table 5. Time to dice cooked potatoes for hashed brown potatoes, original method, employee No. 1

Study No.	Net weight of cooked potatoes diced (pounds)	Time (minutes)	Minutes per pound
1	18.75	17.00	.91
2	16.75	13.60	.81
3	18.12	16.95	.94
4	16.62	12.75	.77
5	16.00	14.27	.89

Employee No. 1 was the worker usually responsible for this menu item. It is of interest to compare her rate of production with that of another worker, employee No. 2, who also cut each potato with a paring knife but used a less efficient method than employee No. 1. Data for employee No. 2 are shown in Table 6. Since the comparison of the original and improved method is on the basis of employee No. 1, a breakdown of the method used by the other worker is not given.

Improved method. The author tried the methods using the electric cutters again only to find the experience of the supervisors repeated. One machine cut the potatoes too fine and tended to mash the potatoes. The other machine would cut a few pounds of the cooked potatoes in an

acceptable way, but the blades soon became coated and mashed rather than cut the potatoes. Cutting the potatoes before they were cooked was also tried, but the method finally accepted was considered a superior one.

The author discussed with the Dietitian the possibility of developing a cutter similar to a butter cutter. The Dietitian recalled having seen a similar piece of equipment especially designed for dicing potatoes. She very shortly afterward had an opportunity to see the apparatus demonstrated and subsequently purchased it for use in the kitchen.

Table 6. Time to dice cooked potatoes for hashed brown potatoes, original method, employee No. 2

Study No.	Net weight of cooked potatoes diced (pounds)	Time (minutes)	Minutes per pound
1	19.12	37.60	1.97
2	13.12	20.60	1.57
3	16.12	18.14	1.12

The workplace layout for use of the new equipment is shown in Figure 12. In general, the process used with the new equipment consisted of pushing the potatoes through two plates on which stainless steel wires were strung. The first plate had wires in only one direction. The second plate had wires in two directions. After the potatoes were pushed through the second plate they dropped into the pan on which the apparatus was placed.

There was some question on the part of employee No. 1 as to the practicality of this newly purchased piece of equipment even though the other

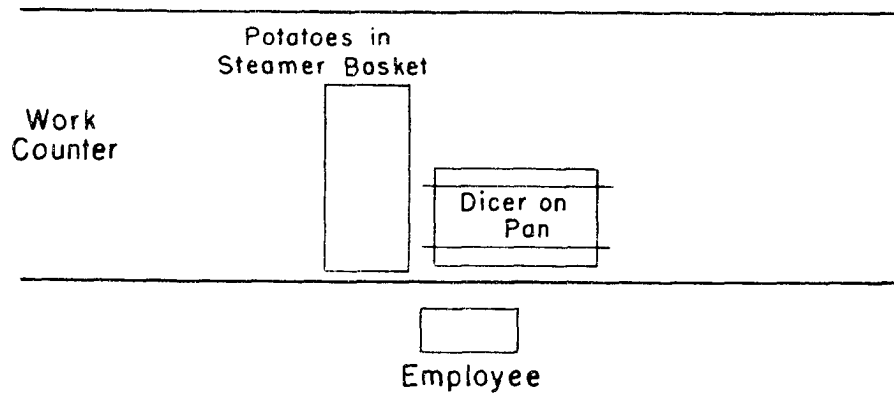


Fig. 12. Workplace Layout, Dicing Cooked Potatoes for Hashed Brown Potatoes, Improved Method

cooks accepted the use of it immediately. By the time hashed brown potatoes were on the menu a second time, she was enthusiastic about the use of the equipment. In Table 7 is shown the results of time studies made during the use of the improved method; results are presented in the sequence in which the studies were made. Preliminary studies a, b, and c were made during preparation of hashed brown potatoes the first time

Table 7. Time to dice cooked potatoes for hashed brown potatoes, improved method, employee No. 1

Study No.	Net weight of cooked potatoes diced (pounds)	Time (minutes)	Minutes per pound
a	13.50	9.55	.71
b	14.75	9.20	.62
c	13.25	8.45	.64
1	15.75	4.75	.30
2	17.88	5.55	.31
3	17.25	5.50	.32
4	15.50	6.00	.39
5	16.00	5.85	.37

this item was on the menu after the new method was used. Studies one through five were made during the preparation of potatoes the second time this item was on the menu. By the time these latter studies were made the employee had increased her skill considerably in the use of the equipment.

During the latter five studies, the employee used three different techniques to grasp and cut the potatoes; more than one technique was sometimes used during a specific study. The techniques are described in Operation Sheets No. VIII, IX, and X in Appendix B. It was found that technique No. 3 was superior to both No. 1 and 2. A comparison of the three techniques is given in Table 8.

Table 8. Dicing one cooked potato for hashed brown potatoes, improved method, employee No. 1, comparison of three techniques

Activities	Techniques		
	No. 1	No. 2	No. 3
Left hand			
Operations	2	2	2
Transportations	2	2	2
Delays	3	1	0
Right hand			
Operations	3	3	2
Transportations	2	2	2
Delays	2	0	0

The chief difference was the amount of time one hand was idle, which is indicated as delays in Table 8. To actually push the potatoes through the lower plate a slide movement was often combined with an application of pressure. In some instances (as in techniques No. 1 and 2), particularly when the potatoes were large, two movements were used for this

process, first an application of pressure and then a slide movement combined with an application of pressure.

Discussion. There was a 64 per cent decrease in the time when the improved method was used. This comparison is based on median rates, study No. 5, of the original method shown in Table 5, and study No. 3 of the improved method shown in Table 7. Approximately 425 pounds of cooked diced potatoes were usually needed for one meal. On this basis the time for cutting alone could be decreased from 6.30 to 2.27 hours. There were, of course, other steps in the total procedure including peeling and eyeing of potatoes, steaming, storing in refrigerator, browning on the griddle top range, and serving.

The potatoes diced with the new piece of equipment were more uniform in size than those cut with a knife. The employees expressed the opinion that the final product was improved. The new piece of equipment purchased for dicing potatoes was very rapidly adapted for other purposes including dicing potatoes for salad, cutting cooked eggs for salads, and for slicing or dicing bananas. The latter process was suggested by the author, but the other two adaptations were made by the employees. The time needed for the above processes were all decreased considerably by the use of this piece of equipment. On one occasion the author observed two employees using the apparatus at the same time; one was putting eggs through and the other potatoes. Both could be combined in the pan below since they were for potato salad.

Making ham salad sandwiches

Although the method used to make sandwiches was apparently a very efficient one, the process was selected as one of the jobs to be studied. Some reasons for studying this particular job included the following: sandwich making methods have often been greatly improved by application of work simplification principles; even with the efficient methods used, the job was considered to be an especially time consuming one; and since one of the motion pictures used in the training program was specifically concerned with techniques of sandwich making, it was believed desirable to follow through on this work process by analyzing the method used by the workers.

It was difficult for one observer to attempt a detailed analysis of the over-all process. The employees dovetailed different aspects of the work; for example, one employee might replenish the supply of bread for all three of the employees. General observations were made, however, of the total operation, and the specific operation of making the sandwiches was studied for one employee.

A limiting factor in making time comparisons between methods was the infrequent repetition of any one kind of sandwich. Some of the aspects of sandwich making were alike, nevertheless, regardless of the specific sandwich filling. The procedure followed in studying the sandwich making process varied from that used in studying other work processes since only during the first time the process was studied were no variations introduced. During the other four periods some experimentation was done by introducing variations in the method. The menu was revised two different times at the

request of the author in order to have the last two periods of observation, but these two periods were not typical of the usual circumstances because the number of sandwiches prepared was less. It is not, therefore, considered feasible to make definite recommendations in regard to an improved method. Suggestions will be made as a basis for further study.

Original method. Approximately 1500 sandwiches were made the first three times of observation; fewer were made the last two periods. The sandwiches were left whole. Usually three employees made sandwiches at one time, although occasionally four employees would help with the job.

Slices of bread were placed on a 17 x 25 inch tray. If sandwich bread were used, 24 slices would fit on the tray; if regular bread were used, only 20 slices could be placed. Using a No. 20 scoop, the ham salad mixture for each sandwich was portioned from the pan adjacent to the tray on the right, and was placed in the middle of each slice of bread. The next process was to spread the mixture on each slice of bread. Then slices of bread were placed on top to complete each sandwich, and a piece of paper was placed on top of the sandwiches. The above processes were repeated until there was a total of five layers of sandwiches on a tray, 100 or 120 depending on the size of the bread used. Each completed tray of sandwiches was covered with cloths and one or two trays at a time were taken to the refrigerator on a movable table.

Discussion. Based on observations of the sandwich making process and preferences indicated by the employees, the following were some of the procedures or conditions for which improvement seemed possible:

1. Location of equipment.

Often considerable time was spent when setting up the workplace layout to find the scoops and spreaders needed. Either a rubber scraper, a pie knife, or a short, thin spatula was used to spread the filling, depending upon the preference of the individual worker. A sandwich spreader was secured from another unit of the food service for use in some of the experimentation done. Some plan for fixing the location of small equipment would appear to be desirable for this work process as well as other processes in the kitchen.

2. Layout.

Sandwich making operations were sometimes inhibited because the work area was congested with such things as a case of canned goods or pans for butter. Sufficient available space for best arrangement of the layout is needed.

3. Transporting boxes of bread.

If regular one and one fourth pound loaves of bread were used, about 166 loaves or nine boxes of bread were used. If one and three fourths pound sandwich loaves were used, about 115 loaves or eight boxes of bread were used. Individual boxes of bread were occasionally carried from a storage place approximately 40 feet from the work area; however, a movable table was sometimes used for this process. By using a movable table all the bread needed could be taken to the work area in a few trips and could be done by a student worker before beginning the sandwich preparation. In order to keep the aisles between the work counters clear, two boxes of bread could be placed on the work counter and the remainder of the boxes at the end of the counter.

4. Transferring bread to counter.

The method used to transfer the bread from the boxes to the work counter varied. One determinant was the amount of space available at the workplace. If the workplace arrangement were such that there was sufficient space, two workers could together dump an entire box of bread on the table at one time.

5. Kind of bread.

If the smaller loaves of bread were used, it was necessary to tear open bread wrappings more frequently since there were not as many slices in these loaves. In addition the slices of bread from the regular loaves were more irregular in shape

and size than the sandwich bread, and consequently more difficult to spread evenly with the filling. The sandwich bread was also to be preferred because 24 rather than 20 slices could be placed on the tray at one time. On one occasion some of the loaves of bread had been crushed and as a result the slices were irregular in shape. This condition made it more difficult to spread the filling.

6. Opening bread wrappings.

To open a bread wrapping a small piece of the paper was taken between the thumb and finger and a strip was torn the full length of the wrapping. This appeared to be a very effective procedure, for it was quickly done, no tool had to be grasped to perform the operation, and the wrapping was opened the full length of the loaf. When bread was wrapped in wax paper it was relatively easy to tear, but on one occasion when the bread was wrapped in Cellophane it was much more difficult to tear. Wax paper wrappings are to be preferred.

7. Placing slices of bread.

The loaves of bread were placed adjacent to the tray on the left. Approximately six slices were grasped in the left hand at one time, and the left hand held the bread near the position at which it was placed on the tray as the right hand was used to place the bread on the tray. The author experimented with grasping several slices of bread in both hands and placing two slices at one time. The slices of bread would often stick together at the crust, however, so that this method was not as effective as that used by the workers. One employee stated she could save time if she grasped a larger number of slices in her left hand at one time.

8. Containers for heels of bread.

The procedure used to dispose of the heels of bread from each loaf was to toss them into two pans which were located in front of one of the employees but about six feet away from the work area of the other two. As a result the bread sometimes fell outside of the pans, thereby cluttering the work area and necessitating picking up the bread when the work area was cleared. Pans could be arranged to be closer to each employee.

9. Waste paper.

There were no containers for waste paper near the workplaces; therefore, the work area would sometimes become cluttered with bread papers. By having containers close to the workplaces, the papers could be disposed of regularly and thereby eliminate travel

to the waste container and also keep the work area in order.

10. Tearing sheets of paper.

The sheets of paper used between the layers of sandwiches were torn from a roll of paper which was placed at one end of the counter on which the sandwiches were made. Although some sheets of paper were torn in advance, there were usually not enough for the entire sandwich making process. During the initial observation of one employee in the latter part of the over-all work process, a trip was made to the roll of paper to tear off each sheet needed. The approximate number of sandwiches to be made was known in advance, and a saving in time and energy could be achieved by tearing all of the papers at one time and then placing them in a location convenient to each worker.

11. Position of tray.

The trays on which the sandwiches were made were placed with the width parallel to the edge of the work counter, and the sandwich filling was in a pan adjacent and parallel to the length of the tray at the right. Consideration was given to placing the length of the tray parallel to the edge of the counter in order to decrease the length of the reach during the spreading process. When the pan of sandwich filling was placed behind the tray, the process of scooping the filling out of the pan was at least 18 inches from the worker; this arrangement was not convenient. When the pan of sandwich filling was placed parallel to the width of the trays at the right, the lengths of the moves to place the filling on the bread were increased. One employee who was relatively short preferred this latter arrangement, but the other workers preferred the original arrangement in which the width of the tray was parallel to the work counter.

12. Motions to spread filling.

Some experimentation was done with one employee in regard to the motions used for spreading the filling on the bread. As indicated previously, the shape of the slice of bread was to some extent a determinant. In the original method, the filling was placed in the center of the bread. For one employee the two patterns of motion used most frequently to spread the filling were methods A and B shown in Figure 13. Another method was tried by placing the filling in the upper half of the slice and then flattening and spreading with one downward motion, method C in Figure 13. On the basis of the comparisons made, this latter method did not seem to be consistently quicker, and the worker and the author agreed that the filling was not spread

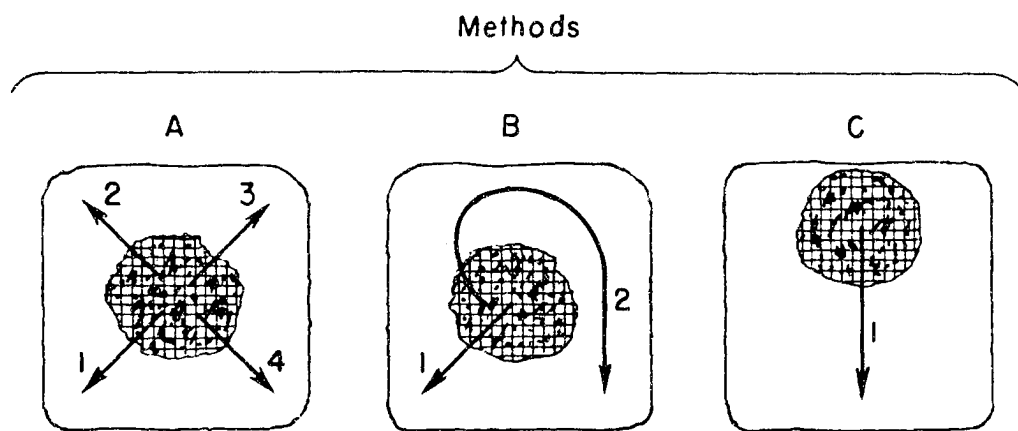


Fig. 13. Patterns of Motions Used to Spread Sandwich Filling

to the edge as neatly as with either one of the previous techniques. The S-shaped motion, recommended in the motion picture used in the training program, was also tried, but the employee found in this particular situation it was necessary to hold the spreader in an almost horizontal position, and the hand often scraped the filling on the other sandwiches. With a different type spreader, other results might have been found.

No definite conclusions were reached regarding the method of placing bread on the trays, the best position of the trays, the technique to use to spread the filling, and some of the other aspects of the work process. It would appear on the basis of observations made, however, that the points discussed above affected the efficiency of the work process. One proposed layout of the workplace when there are three workers is shown in Figure 14. The trays are arranged in two different positions to meet the preferences of the workers.

In relation to the objectives of the present research, the most significant aspect of the studies made of the sandwich making process was the willingness of the employees to accept changes that were suggested and to experiment with certain phases of the work. This cooperation was particularly noteworthy in view of the fact that it was the general consensus of opinion among the workers that their original method was a good one. The employee who changed the position of the tray did so on her own initiative as a direct result of the discussion in one of the training classes about the normal and maximum working areas. She stated that she always thought it would be better to have the length of the tray along the edge of the counter, and that now she had a reason for changing it even if the other workers preferred the original position.

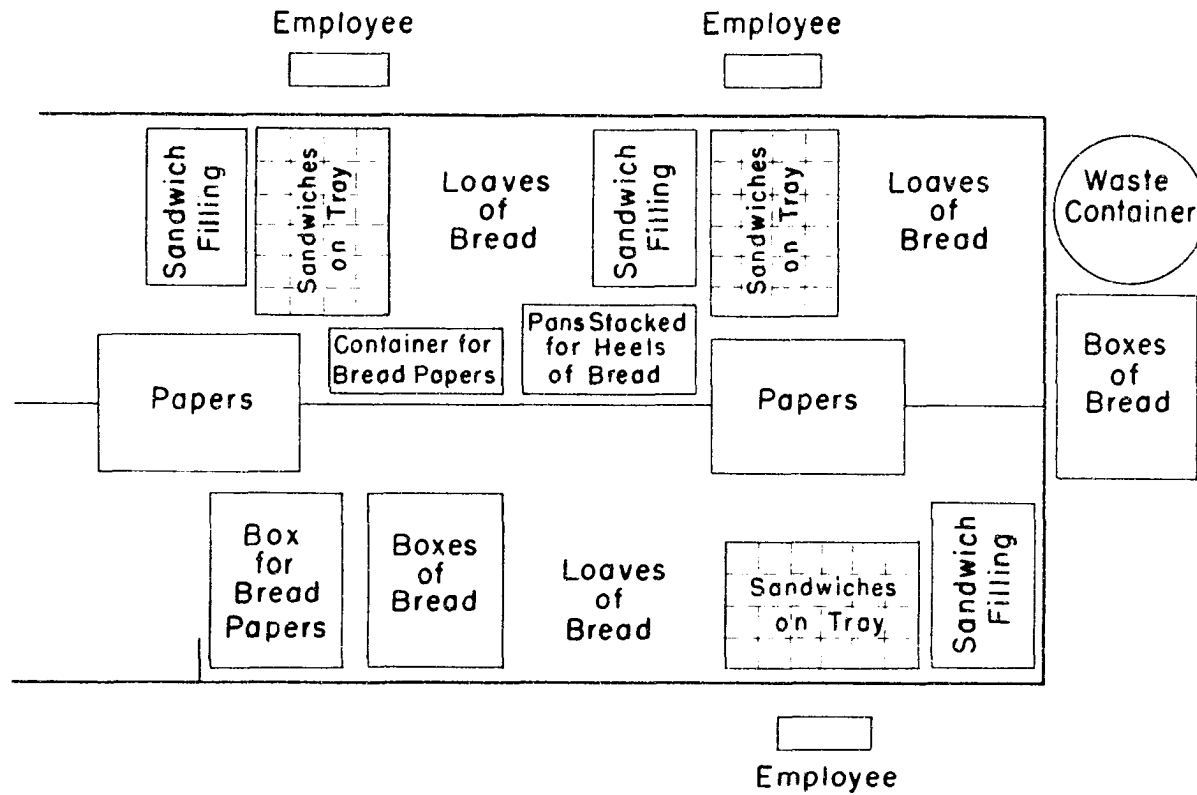


Fig. 14. Workplace Layout, Making Ham Salad Sandwiches

On one occasion the author set up the workplace before the work process was begun. Little comment was made to the employees about it; nevertheless, the next time many of the features of the layout set up by the author were incorporated when the workers arranged the layout. The one employee with whom the author worked in experimenting on the best motions for spreading the filling was willing each time to try any technique suggested, and the other workers often tried them too even though they were not asked to do so.

In addition, the study of this process exemplified the fact that actual on-the-job experimentation is often needed and desirable in developing improved methods. It would also suggest that if the employees have some understanding of the purpose of the trials, the effect of unsuccessful attempts do not have an adverse influence on the job improvement process. Further, some on-the-job experimentation provides a situation that will encourage suggestions from the employees.

Transporting equipment and supplies

Early in this research project the Dietitian told the author it was known that the bakeshop area was too small to permit the most efficient operation of this unit, and she indicated a desire to receive suggestions for revision of the present layout and equipment to facilitate the work processes.

During the period of the research numerous analyses were made in this area which revealed opportunities for improving some work processes. In practically every instance the improvement was dependent on a change in the present equipment or its location. Suggestions were given to the

Dietitian for possible application in the future.

An example of one analysis made in the bakeshop is given. This analysis concerned the transporting of equipment and supplies.

Original method. A layout of the bakeshop is shown in Figure 15. Portioning of desserts was done on the counter top of cabinet A and the baker's table B. When all of the dessert was portioned from a pan, the worker at table B would scrape the remaining contents of the pan into the garbage can and then place the pan either on the sink counter or on the waste can near the sink. The worker portioning desserts at cabinet A often followed the same procedure, thus necessitating a round trip travel distance of approximately 28 feet to dispose of the empty pan. During the latter part of the period over which observations were made, a drum of shortening was stored at the south end of the baker's table. When the drum of shortening was in this location, the empty pans used at cabinet A were sometimes stacked on top of the drum and the scrapings from several pans were emptied into one pan.

In addition to the above procedure, it was noted that there were frequent trips to the pot-washing unit outside the bakeshop. The distance from the bakeshop door to the pot-washing unit was approximately 20 feet. In addition to the trips to the pot-washing unit, it was sometimes necessary to bring in or take out additional trays or other equipment or supplies, and frequently these were carried because an easily operated movable table or cart was not readily available. Sometimes the weight of the loads carried would be between 20 and 30 pounds.

For example, during one two and one half hour period of observation

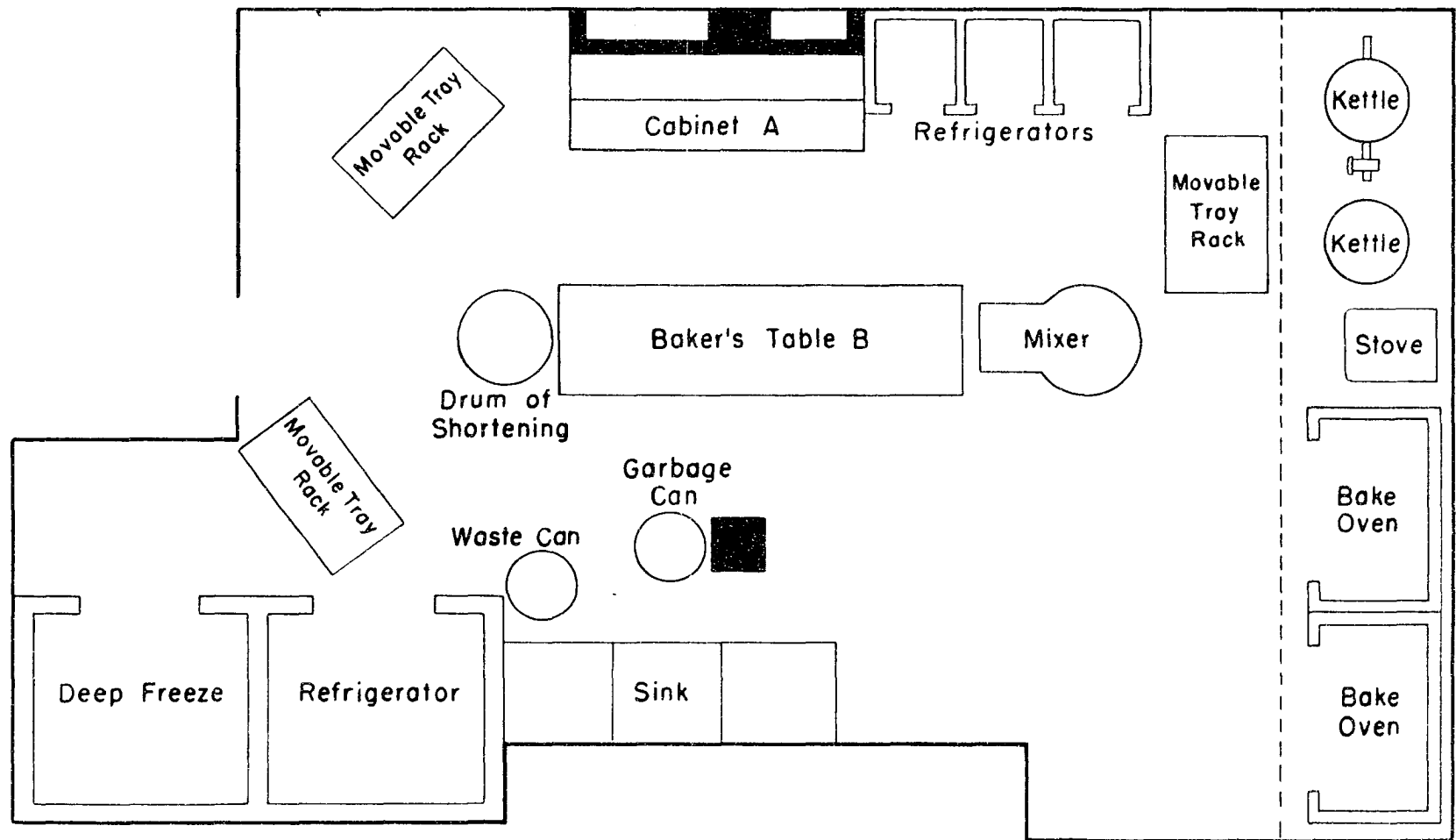


Fig. 15. Workplace Layout, Portioning Desserts in the Bakeshop

the following trips were made in and out of the bakeshop.

Worker No. 1 (Time working in unit 2 hours and 30 minutes)

1. Towels secured from laundry supply at opposite end of kitchen
2. Miscellaneous pans and equipment carried to pot-washing unit
3. Two cake pans carried to pot-washing unit
4. Five cake pans carried to pot-washing unit
5. Six cake pans carried to pot-washing unit
6. Six trays carried from salad unit
7. Five cake pans carried to pot-washing unit

Worker No. 2 (Time working in unit 2 hours and 30 minutes)

1. Opened No. 10 cans of plums brought in on a movable table
2. Clean apron secured from laundry supply at opposite end of kitchen
3. Six trays carried from salad unit
4. Four cake pans carried to pot-washing unit

Worker No. 3 (Time working in unit 2 hours and 20 minutes)

1. Two cases of opened No. 10 cans of fruit cocktail brought in on a movable table
2. Empty banana crate carried to kitchen
3. Two cases of empty No. 10 cans carried to kitchen
4. Two large pans, two colanders, and some miscellaneous equipment carried to pot-washing unit
5. Collar to mixing bowl and whip attachment carried to pot-washing unit
6. Six cake pans carried to pot-washing unit
7. Seven cake pans carried to pot-washing unit

Worker No. 4 (Time working in unit 50 minutes)

1. Stack of trays brought in on a movable table

The movable tables mentioned above in the description of trips made in and out of the bakeshop were stainless steel tables with a top surface area of 24 x 36 inches. When in the bakeshop, they were utilized as a working space or to hold supplies or equipment being used. Although these tables were sturdy in construction, they were not easily maneuverable.

Discussion. Both of the above described work processes, the transporting of empty pans within the bakeshop and the transporting of equip-

ment and supplies between the bakeshop and the kitchen, provided a basis for the conclusion that a small, easily moved table stationed at the place where the drum of shortening was located could be used to considerable advantage. Empty dessert pans could be stacked on it, and it could be used to transport items to the pot-washing unit and to and from the kitchen. Its use would decrease to some extent the number of trips, and the necessity for carrying relatively heavy loads would be eliminated. Permission was secured to move the drum of shortening to a nearby location in the kitchen, and a small, easily maneuvered table was placed at the end of the baker's table.¹

On certain occasions during the research project a small table had been kept in this location at the end of the baker's table, but it was not always there, and after the drum of shortening was moved into the space it was, of course, not possible to have the movable table.

During the period of observations the author asked the workers in the unit regarding the possibility of using a movable table or cart to transport more of the equipment and supplies. Two factors seemed to be related to the current practice: one, the workers had been instructed to take the pots and pans to the pot-washing unit as they accumulated so that the work of this unit would not come all at one time, and two, an easily manipulated table or cart was usually not available, and it was easier and quicker to carry the items than to find a cart.

One of the small, movable tables in the food service unit was secured to be stationed in the bakeshop. During a period of approximately

¹The shortening was used for pie dough about once a week.

three weeks the workers were frequently observed using the small table. On two occasions at the end of approximately two weeks, however, when the author had planned periods of observation in the bakeshop, the table was not there. The workers hastened to explain that frequently the table was removed from the bakeshop for use in other areas. The workers apparently would have used the table, but it appeared difficult to keep it always available.

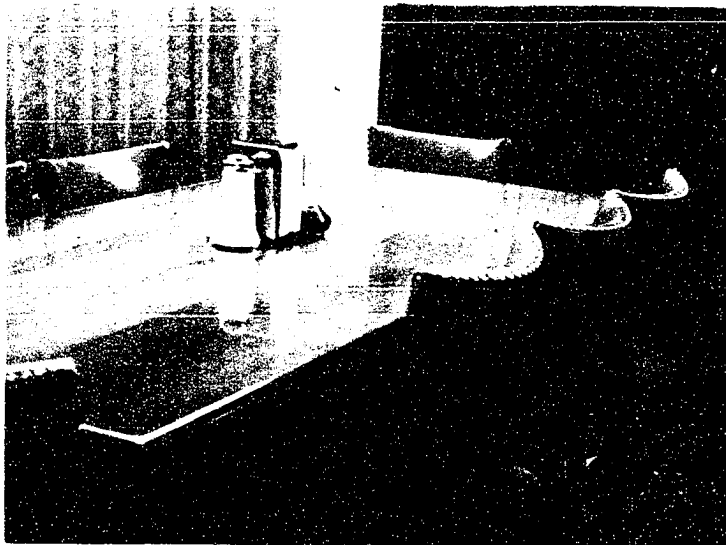
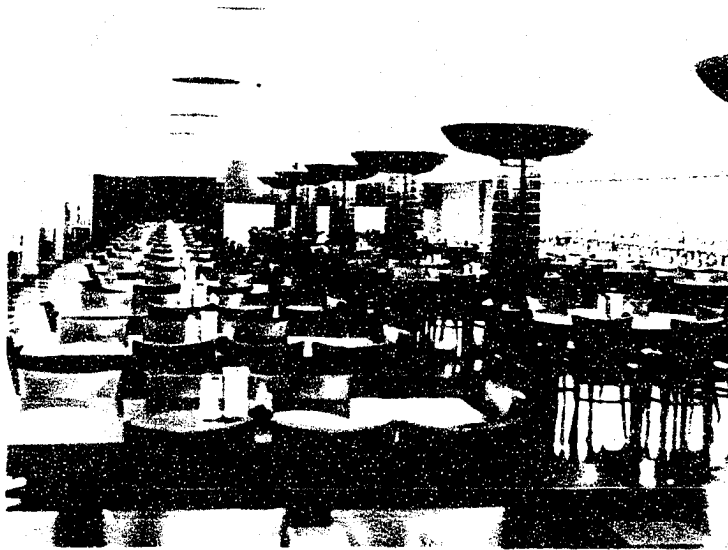
It is believed desirable that a small, movable table be kept available in the bakeshop. This may be accomplished by specifically labeling one of the tables and instructing other workers of this arrangement, or by purchasing a small cart or table especially for this unit.

Inspecting and setting up dining room tables

One full-time employee was responsible for the care of the east dining room, except the floors. The tables were arranged as shown in Figure 16. In the center of each table was a napkin holder, sugar shaker, salt and pepper shakers, and a vinegar cruet; these will hereafter be referred to as a centerpiece. It was considered very important for a satisfactory appearance of the dining room that the items in the center of each table be in alignment with those on the other tables in the same row. There were 42 dining room tables; all were rectangular in shape except nine round ones. The tables had a $1/4 \times 1/2$ inch ledge at the edge. The centerpiece and ledge are shown in Figure 17. The process of inspecting and setting up the dining room tables after each meal consisted of washing and drying the tables as needed, inspecting the centerpiece,

Fig. 16. Arrangement of Tables in Dining Room

Fig. 17. Dining Room Table and Centerpiece



and wiping off and refilling the items as needed.

Original method. The employee began inspection and set up of the tables in the southwest corner of the room. A 24 x 36 inch cart was used to transport the equipment and supplies needed, but the cart was not easily maneuvered. The west row of tables was completed first, then the middle row and east row were done alternately as the cart was moved down the aisle between these two rows.

The procedure followed was to roll the cart to a position about 3 or 4 feet from the dining room table. Taking a washing cloth in one hand and a drying cloth in the other, the employee washed and dried the table. For the rectangular tables, the entire width of the table was wiped from one side; the table was 38 inches wide, and when reaching across the table, the employee usually stood behind the chairs arranged at the table. The total distance from the body position to the opposite side of the table was approximately 44 inches, and the worker's height was five feet. When washing and drying the round tables which had a diameter of 66 inches, the worker walked completely around the table.

The washing motions were not done at the same time as the drying, but the two operations were usually done with different hands and without grasping and releasing the cloths except when the worker stopped to do the work related to the centerpiece. The washing was with the right hand and the drying with the left.

The order of work varied considerably. Some times the work related to the centerpiece was done during the table washing and drying process, and sometimes it was done at the beginning or end. Likewise, the order

of work related to the centerpiece varied. One sequence followed, for example, was:

- Wipe sugar shaker and place at side
- Wipe napkin holder
- Walk to cart and refill napkin holder. Return
- Move salt and pepper shaker and vinegar cruet
- Wash and dry table where centerpiece is to be placed
- Position centerpiece items and align with centerpieces on tables previously completed.

If more than one centerpiece item had to be refilled, frequently separate trips to the cart were made. Often to align the centerpieces with those on the other tables that had been completed, the worker would stoop in order to view the centerpiece at eye level. Occasionally when this was done a previous table centerpiece was found to be out of line; then the worker would return to adjust the location of the centerpiece on that table and subsequently those on the intervening tables. The first time the work process was observed, this was done two times, the second period of observation three times, and the third period once. Less care was taken to position the centerpieces on the middle row of tables because the centerpieces could not be viewed at one time since columns obstructed the view.

When the work at one table was completed, the employee returned to the cart. Usually the wash cloth was dropped in a pan of water and detergent. After the cart was moved to the next table, the wash cloth was wrung out for use. An additional supply of dry cloths was kept on the cart.

Not infrequently there were changes from the general pattern of work stated above. Occasionally the worker would:

Walk around the table to wipe off the table or to wipe the
ledge at the edge of the table
Wipe the upholstery on a chair
Move a table slightly

On three occasions when the complete operation of inspection and set up of the dining room tables, using the original method, was observed the time varied from 75 minutes to 43 minutes. Because of the many variables affecting this work process, comparison of time using different work methods was not practical.

Some of these variables included the following: 1. If student employees who were assigned to duties in the dining room had available time, they were instructed to wipe off the table; 2. the number of tables which was used varied from one meal to the next; 3. the menu influenced the extent of soil on the tables; and 4. the amount of time the employee had available to do the job varied.

Improved method. The improved method proposed and tried out included the following innovations:

1. The cart was moved as close to each dining room table as possible. Since it was not easily maneuvered the route of the cart was kept in a straight line rather than brought in between the tables.
2. For each table all items to be refilled or replaced were returned to the cart in one trip.
3. When the employee completed one table, she moved to the next table and washed and wiped the adjacent side of that table before returning to the cart.

4. A small mark was painted on the tables to indicate the position at which the napkin holder should be located.
5. A definite sequence of procedure was followed.

By moving the cart closer to the table and by reducing the number of trips to the cart, the number of steps was reduced. In order to wipe the tables from two sides instead of one, the number of steps was increased, but the length of reaches when washing and drying the tables was reduced. This procedure also enabled a closer inspection of the ledge around the edge of the table and, when needed, the ledge could be wiped easily. The positioning of the centerpiece was simplified by placing a mark on the tables to indicate the location of the napkin holder. In order for this innovation to be effective, it was necessary to be sure the tables were in alignment. They usually were, since the legs of the table were aligned according to the blocks of the floor covering, but occasionally the worker had to adjust the position of a table slightly. By having a definite sequence of procedure it was expected that the chance for omitting some part of the procedure would be lessened and the work would, with practice, become more automatic.

Discussion. Following one period of observation of the original method, the author discussed the procedure used with the employee. The worker mentioned that in order to reach the full width of the table it was necessary for her to stretch. When the improved method was summarized and presented to the employee by the author, she stated that the suggested procedure of wiping the table from two sides was made as a result of the employee's comment.

The opinion of the worker was secured in regard to most of the changes finally included in the improved method. In fact, before a final decision was made to paint the marks on the table, plastic tape was placed on one row of tables to get her reaction after she had had an opportunity to use it for a period of time. The possibility of using simultaneous motions to wash and dry the tables was tried out one time but was considered by the worker to be more fatiguing.

The worker appeared to be willing to adopt the improved method although she delayed somewhat in doing so because there was an increased amount of work to be done right after the time the improved method was suggested, and she did not want to take the time to learn a new method. There was some question on her part as to the feasibility of following a definite sequence of procedure. It is recognized by the author that some of the variables mentioned before make variations in procedure from one table to the next necessary.

This was the only work process studied in which the sequence of procedure for the improved method was presented to the worker in a typed form. Although the proposed procedure was also explained verbally, it is possible that receiving the new procedure in a typed form may have given the impression that the new method differed more from the original method than it did. In addition the author presented the improved method to the worker at a time when she was not actually doing the job. This timing may not have been advisable from the standpoint of learning the process.

Unfortunately there was not sufficient time during the study for the

worker to develop skill in the use of the improved method, for it was introduced very near the end of the school year. The employee stated, however, that the improved method was easier. Probably the most important innovation to the worker was simplifying the positioning of the center-piece. Use of the improved method probably would not result in any appreciable decrease in the number of steps or in the time. The use of a more easily operated cart would further facilitate the work process. A worker who is taller than the employee for whom the above process was developed may prefer to wipe the tables from one side.

An employee would need to be carefully instructed if expected to follow the procedures described for the improved method. For example, the use of the marks on the tables as a guide to positioning the center-piece is not obvious unless some instruction is given. This fact became apparent from observing the workers who did this job on the full-time worker's day off.

OUTCOMES OF THE WORK SIMPLIFICATION
TRAINING PROGRAM FOR FOOD SERVICE EMPLOYEES

Interpretation of Outcomes of Situation Tests

One of the bases for interpreting the effect of the training program was the responses made by the employees to the situation tests. After an explanation is made of the scoring procedure, the test scores on a group basis are presented and interpreted. Further interpretation on the basis of the scores of individuals or sub-groups of individuals is given. Other outcomes presented include changes in methods of work and reactions of the employees. The presentation of outcomes is concluded by a discussion of outcomes in relation to the purposes of the research project; this discussion includes a consideration of research methodology and a statement of hypotheses.

Procedure for scoring the situation tests

A score sheet for each test was designed to expedite the scoring process and to assure consistency in scoring. The responses which it was believed would be made most frequently were grouped according to type of suggestion and were printed on the score sheet with the score allowed for the suggestion. The responses made by every individual, to whom each of the four situations tests were administered, were scored using separate copies of the score sheets. When one of these responses appearing

on the score sheet was made, the score for the response was circled. If a suggestion by an individual were made that was not included among those on the score sheet, it was written in a blank space and assigned a score. A separate record was kept of such suggestions to assure consistency in the assigning of scores to the additional suggestions.

The bases for scoring the responses of each individual were as follows:

1. Responses which indicated application of work simplification generalizations were assigned a score on the score sheet. The generalizations applied might be those presented in the training program or others. A response was considered to make application of a work simplification generalization if the suggestion could result in a saving of time and/or energy.
2. The largest scores were given for those suggestions which unquestionably afforded the greatest savings in time and/or energy. For example, the following were scores assigned to responses made to situation test I, serving soup:

<u>Scores</u>	<u>Suggestions</u>
4	Use larger ladle for ladling the soup
3	Use left hand to pass the bowl to the person
2	Hold bowl to the left, not directly in front
2	Do not release handle between ladling process

3. A suggestion was not rejected because the person making the response did not know some requirement of the work process. For example, if a person suggested a method which would simplify

the process of eyeing potatoes but which would result in the potatoes turning dark when standing, credit was given for the method suggested.

The same procedure was used for scoring the responses of the student group and the food service employees.

Many specific decisions in regard to the scoring procedure had to be made in order to assure that every test would be scored on the same basis. Leniency was a policy. If alternative suggestions were given for a particular process, credit was given for each suggestion even though they might be similar. There were instances, however, on two of the score sheets when a maximum limit was placed on the number of alternative specific suggestions that could be made about one phase of a process. This was done in order to avoid having very minute changes in regard to one process affect the total score out of proportion to its contribution to the total process. Credit was allowed for a general suggestion and also if a specific application of the general suggestion were given. An example of a general suggestion for test I was to have the supply of bowls within easy reach. An example of a specific suggestion in regard to the same point was to have the bowls in a Lowerator to the left of the worker. If an inefficient process were cited but the response did not include or infer a possible means for improvement, only half of the score was given that would have been received had a suggestion been made to correct the process. Likewise, only half credit was given for a suggestion if it were not fully enough developed to indicate to the judges that the worker had a clear understanding of the idea. The number of suggestions

of merit which were not related to work simplification were tabulated at the bottom of the score sheet, but no score was assigned for these. If a response made were not pertinent or had no merit, it was circled on the original record of the responses of an individual, but no record was made of it on the score sheet.

The general procedure described above was followed for assigning scores, but individual judgments were often necessary for evaluating a particular response. The scoring was done by the author, and a sample of responses was checked by another judge. The scoring by the second judge was in agreement with that done by the author. Considerable care was taken to assure consistency. For example, before the responses were scored when tests I and II were used as a re-test, the previous scoring of these tests was completely reviewed.

Interpretation of tests, group basis

A description of the tests and their administration to the workers and students has been given in an earlier section. A brief summary is included here for reference. The subjects of the situation tests were:

<u>Tests</u>	<u>Subjects</u>
I	Serving soup at a cafeteria counter
II	Making sandwiches
III	Eyeing potatoes
IV	Setting up trays in the floor kitchen of a hospital

The student group responded to the four situation tests without any training intervening between the tests. The sequence of activities related to the program for the workers is shown below with the time interval for

each activity:

<u>Time interval</u>	<u>Activity</u>
Four days	<u>Pre-test (tests I and II)</u>
Three weeks and four days	General observation and analysis of original methods of work
Three weeks and one day	Seven work simplification classes
Four weeks	Development and installation of improved methods for eight work processes
Three days	<u>Post-test (tests III and IV)</u>
One week	Continuation of development and installation of improved methods
Twelve weeks	No contacts with employees
Three days	<u>Re-test (tests I and II)</u>

There was a period of approximately 11 weeks intervening between the administration of the pre-test and the post-test to the employees, and there were approximately 25 weeks between the time when tests I and II were given as a pre-test and as a re-test.

Test scores. The objective in administering the situation tests to the employees was to provide one basis for determining whether the workers were better able to make application of work simplification generalizations after the training program than they were before. The ability to make application of the generalizations was considered as evidence of understanding.

A paper-and-pencil test was not appropriate as an evaluation technique for the food service employees because they varied greatly in their ability to express themselves in writing. In developing the situation tests an attempt was made to eliminate the effect of this variable by use

of oral responses recorded by the author. No record was found in the literature of a test like those developed for use in this study. They were in some respects like a short answer test of ability to apply generalizations (5, 58), and in other respects like an essay test. They varied from the usual types of problem solving tests, however, in that a motion picture was used to present the situation, and the responses of the workers were made verbally. The workers were not asked to give reasons for their suggestions. The assumption was made that giving a suggestion indicated some degree of understanding of a particular generalization.

The test scores of the 30 students and those of the food service workers are shown in Tables 15 and 16 in Appendix C. Scores for 26 workers are shown; however, all analyses of the workers' scores as a group are based on the scores of the first 23 employees. Workers No. 24, 25, and 26 did not attend the training classes. Worker No. 26 did not take tests III and IV.

It is important to emphasize that the raw scores or mean scores for the various tests are not an index of the relative difficulty of the tests. That is, the fact that the mean scores for test I were lower than the mean scores for test II does not indicate that test I was more difficult. It might be as difficult to secure a score of 14 on one test as to secure a score of 18 on another test. Nor would percentage scores for the different tests, based on the relation between the responses given and all possible responses, indicate relative difficulty. For example, 80 per cent of the responses for one test may be above a certain level

of difficulty, whereas on the other test only 70 per cent of the responses may be above the same level of difficulty. Raw scores and percentage scores might be used to compare performance of individuals on a given test, however. In addition, if the relative difficulty of the different tests were known, raw scores and percentage scores might be adjusted so as to reflect differences in accomplishment among tests.

When the present study was designed, it was believed that the test scores of the student group could be used for determining the relative difficulty of the tests. After further consideration was given to the problem, the use of the student group as a basis for equating the tests was questioned because of the small number of students and because it was doubtful whether one could assume that the relative difficulty of the tests would be the same for the student group as for the employees. As a result, tests I and II were administered as a re-test approximately six months after they had been given originally to provide one basis for determining the effectiveness of the training program.

If the assumption is made, however, that these tests are similarly difficult for the students and the employees, some interpretation of the worker's scores may be made in relation to the scores of the students.

A description has been given in an earlier section of how the students were divided into two groups on the basis of previous instruction in work simplification. Half of the students, group A, took tests I and II first and III and IV last, while the other half of the students, group B, took III and IV first and I and II last. This procedure was followed in an attempt to eliminate the effect of sequence in which tests

were taken on the scores for any one test. Comparison of the mean scores, shown in Table 9, suggests that these students tended to do better on the two tests which were administered to them first although this difference may have been due to factors other than order in which the tests were taken. For group A, the mean scores for tests I and II exceeded the means for the total group. For group B, the mean scores for test III exceeded the mean for the total group, and the mean score for test IV closely

Table 9. Mean test scores for students classified according to group

Group	Test I	Test II	Total I-II	Test III	Test IV	Total III-IV	Total I-II-III-IV
A	16.00*	20.27*	36.27	14.33	17.20	31.53	67.80
B	13.67	17.60	31.27	15.53*	17.13*	32.67	63.93
A and B	14.83	18.93	33.77	14.93	17.17	32.10	65.87

*Scores for tests taken first.

approximated the mean for the total group. The results of an analysis of the total scores¹ for tests I and II and the total scores for tests III and IV for the two groups provided additional evidence to suggest that the order in which the tests were taken did make a difference in the test scores. On the basis of the sum of scores for all four tests, however, the variation between groups was almost identical to the variation among individuals (Analysis of Variance A in Appendix C).

¹Scores of individuals on two tests were summed.

The reliability and validity of the tests were not determined, but correlations between the test scores of the students for the various tests were obtained and are listed below:

<u>Tests</u>	<u>Correlations</u>
I and II	.421*
I and III	.097
I and IV	.043
II and III	.305
II and IV	.181
III and IV	.392 *

There were significant correlations only between tests I and II and between III and IV. This fact suggests that tests III and IV did not measure the same thing as test I and II. If familiarity with the work process depicted in the situation tests affected the extent to which the students could recognize ways of simplifying the process another interpretation is possible. That is, the students were alike in their familiarity with the situations portrayed in tests I and II and in III and IV; their familiarity with the situations portrayed in tests I and III, I and IV, or II and III was not as comparable. This latter interpretation has some basis, since work processes similar to those depicted in tests I and II could have been observed or experienced in the quantity food preparation class by all of the students except the four who had not had this course. Conversely, students who had had quantity food service experience in addition to the quantity food preparation course may have been more

*Significant at the five per cent level.

familiar with the work processes depicted in tests III and IV. It was known that some of the students had had experience in other institution food service units.

In Table 10 is shown the estimated possible maximum score for each of the four tests, the mean scores for the students and for the employees with the range and standard deviation of these scores. The mean scores are likewise depicted in the bar chart shown in Figure 18.

Table 10. Estimated maximum test scores, and mean scores of the students and employees with range and standard deviation of scores

Scores	Test I	Test II	Test III	Test IV	Test I	Test II
Estimated maximum	55.	72.	50.	74.		
Students - Mean	14.83	18.93	14.93	17.17		
Range	7-21	12-28	8-22	9-30		
Standard deviation	3.81	4.58	3.13	4.76		
Employees - Mean	7.96	12.35	11.87	10.39	13.61	16.65
Range	2-19	2-26	4-24	2-22	7-19	5-34
Standard deviation	5.10	6.81	4.74	5.07		
	(Pre-test)		(Post-test)		(Re-test)	

The fact that the highest scores of neither the students nor the workers approached the estimated maximum scores, indicates that the tests were sufficiently difficult to measure the upper level of the individuals' ability. The fact that on tests I, II, and IV one or two of the workers

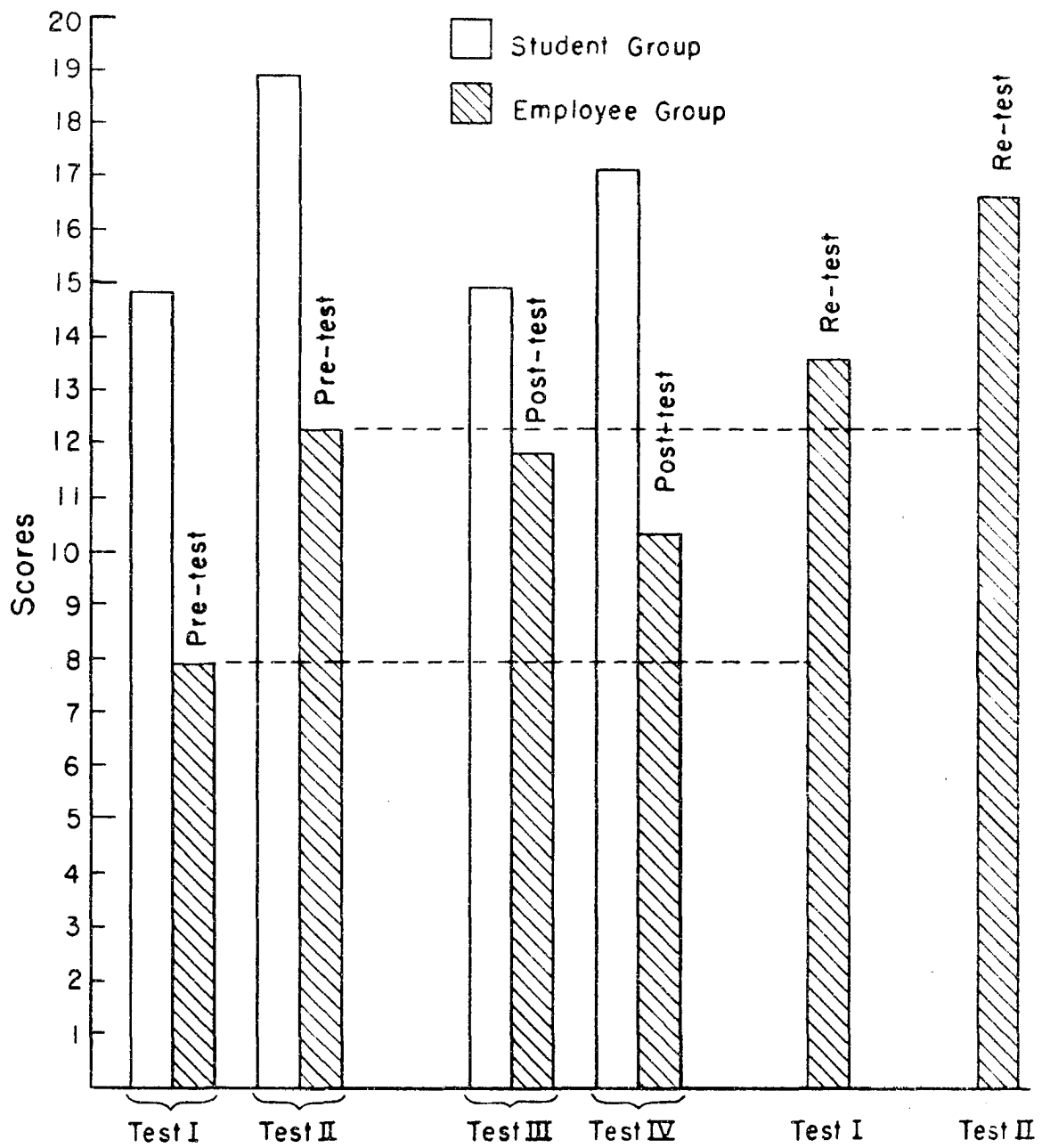


Fig.18. Mean Test Scores for Student and Employee Groups

received scores of two suggests that these tests may have been too difficult to measure the lower limits of ability adequately.

By reference to Table 10 and Figure 18 it will be noted that the workers' mean score was higher for test III than for test IV, whereas the students made a higher mean score for test IV. This relationship suggests the question of the extent to which familiarity with the work process affected the workers' ability to make suggestions for simplifying the work processes. Most of the students were probably equally familiar or unfamiliar with the two processes. Most of the workers were, however, very familiar with the work process in test III, eyeing potatoes, but were unfamiliar with the work process in test IV, setting up trays in the floor kitchen of a hospital. In fact, they probably had more frequent direct contact with the work process in test III than those in either tests I or II. Eyeing potatoes was done in the kitchen every day. Serving soup, test I, and making sandwiches, test II, were only done periodically, and there was in general less opportunity to have participated in or observed these work processes. One might even attribute the higher mean score, in relation to the students' mean score, to the fact that eyeing potatoes may have been a more familiar process to the workers than serving soup.

As might be expected, for each test the standard deviation for the workers' scores was greater than for the students. The group of employees was less homogeneous than the student group in respect to age, past experience, educational level, and sex. Doubtless an important factor in the homogeneity of the student group was that most of them had had the same courses during the previous seven quarters of college work. Seven

of the 23 workers were men, whereas 29 of the 30 students were women.

When the workers were making responses to the tests, it was obvious that they often reacted in terms of their past associations. The suggestions given by them for changing the work processes were frequently based directly on the way the worker had done the process or had observed it being done. For example, after observing the processes of serving soup and making sandwiches, a worker suggested the use of a conveyor belt for both purposes. Other suggestions he made, too, seemed to be related to the experiences he had had or observed when working in a canning factory and a dairy. Recognition of the fact that past associations seemed to have a direct bearing on the responses made, raises the question as to whether the tests did measure ability to apply generalizations. It might have been a measure of ability to transfer a method to a different process without an awareness of the generalization.

In order for an analysis of variance between scores on different tests to have meaning it would be necessary for the scores to be equated as to difficulty. The data collected do not provide a basis for making conclusions in regard to the relative difficulty of these tests. Proceeding on the assumption, however, that tests I and II together were reasonably comparable in difficulty to tests III and IV together, it was found that there was not a significant difference between the total pre-test scores and the total post-test scores of the workers. One might conclude that no gain resulted from the training program. There was, however, a highly significant difference between the pre-test and the re-test scores, and there was also a highly significant difference between

the post-test scores and the re-test scores (Analysis of Variance B, C, and D in Appendix C). In both instances the re-test scores were greater.

Possible explanations of these results are confounded, but one interpretation might be that the post-test, tests III and IV, were actually more difficult than the pre-test, tests I and II, rather than being comparable in difficulty as tentatively assumed above. The hypothesis that tests III and IV together were more difficult for this group than I and II is somewhat in accord with the interpretations made of the correlations between tests based on the students' scores.

In order to accept the significantly higher level of the re-test scores over the pre-test scores as being due to the training program, one must believe that the gain was not due to the fact that tests I and II were being administered for the second time. Approximately a six-months period elapsed between the administration of the pre-test and the re-test, and the workers had not been informed during this period of possible responses to these tests. Shortly after the pre-test was given, there may in a few instances have been some discussion among the workers of possible suggestions for simplifying the work processes, but the workers did not know before the administration of the re-test that the tests they had completed were to be repeated. It would seem reasonable to believe, therefore, that the increase in scores was due, in part at least, to the training program.

Another possible basis for determining whether the workers benefited from the training program is to compare the differences between the total scores for tests I and II and the total scores for tests III and IV of

workers with the corresponding differences for the students. Such a comparison is based on the assumption that the tests were equally difficult for the workers and students. These differences are shown in Table 17 in Appendix C. The mean difference between the scores was -1.67 for the students and 1.96 for the workers. That is, the total scores of the students on tests III and IV combined were on the average 1.67 less than the total scores for tests I and II; the total scores of the workers were 1.96 higher. The variance of the differences for the students was 73.68 and for the workers 91.04. The variances were assumed to be comparable and were pooled to make a t-test. The difference between the means was not found to be significant. This comparison did not, therefore, provide evidence that the workers benefited by the training program.

Age, experience rating, verbalization ranking, educational level, and sex. Comparisons were made between the age, experience rating, verbalization ranking, education level, and sex of the employees and their total pre-test scores and also with their total post-test scores. The age of the workers was determined from the personnel records. Information about work experience and education was secured during the first individual conference with each worker. The age, experience rating, verbalization rankings, and education ratings for each employee are given in Table 18 in Appendix C.

Since work simplification is essentially a problem solving process, it was conjectured that workers who had had the most experience in making decisions, planning their work, and supervising the work of others should evidence the greatest ability in recognizing ways of simplifying work.

An experience rating was calculated on the basis of the type and number of jobs held and the length of time in each job. Jobs were rated according to the following classification.

<u>Rating</u>	<u>Experience</u>
1	Work very routine requiring practically no planning by worker. No decisions necessary except specific method for performing own manual work. Never responsible for supervising the work of others.
2	Partially responsible for planning own work. Making decisions a minor part of work. May supervise the work of one or more people.
3	Responsible for planning own work. Making decisions an important part of work. May supervise the work of one or more people.

For example, the job of farmer, when it included full responsibility for management of the farm, was given a rating of three; likewise, the job of homemaker, when it included full responsibility for management of the home, was given a three rating. An example of a job that was given a rating of one was janitor.

Only jobs held for a year or more were considered. If a job had been held 1-4 years the rating was multiplied by one, 5-14 years it was multiplied by two, and if held 15 or more years the rating was multiplied by three. Thus, by analysis of a worker's experience a total experience rating was derived. Such an analysis obviously was very rough, but there was interest in determining if there were any evidence of a possible relation between past experience and ability to make application of work simplification generalizations.

During the administration of the situation tests, the question of whether or not workers who verbalized most freely and easily were at an

advantage in taking the tests. In order to have some evidence in this regard, the author, the Dietitian, and a supervisor ranked the employees in relation to verbalization. This term was used as meaning "the amount which a worker talks." The worker considered to be most verbal was given a ranking of one. The three judges' estimates of rank of verbalization were not significantly different (Analysis of Variance E in Appendix C); hence, the sum of the rankings was used as a basis for comparison with the total pre-test and total post-test scores.

Correlations between test scores and age, experience ratings, and verbalization rankings are shown in Table 11. None of the correlations was significant. Since there were only 23 in the group, a correlation

Table 11. Correlations between test scores and age, experience ratings, and verbalization rankings

Scores	Age	Experience ratings	Verbalization rankings
Total pre-test	-.163	.196	-.119
Total post-test	-.380	.127	-.124

would have to have been .404 to be significant at the five per cent level. The correlation between the total post-test scores and age had a negative value which approached this level of significance. The correlation between the total pre-test scores and age was likewise negative. The fact that they were both negative suggests that the older workers tended to be less able to make application of work simplification generalizations than the

younger workers if the tests were valid measures of this ability. The correlations for experience ratings and verbalization rankings were so low that there is no evidence of a relationship with test scores.

The fact that there were not significant correlations between test scores and age, experience ratings, and verbalization rankings gives some substantiation to the assumption that the relative difficulty of the tests was similar for the students and the workers.

The educational level of each worker was rated according to the following classification:

<u>Rating</u>	<u>Education</u>
1	Completed any grade, one through eight, or equivalent education
2	Completed any grade, nine through twelve, or equivalent education
3	Completed schooling above the twelfth grade, or equivalent education

In Table 12 the mean pre-test and post-test scores are given for male and female workers of different educational levels. The female workers made higher scores than the male workers in both the pre-test and post-test. All the jobs requiring the greatest ability and skill were held by women workers. One might expect that workers who could perform the jobs requiring the higher degree of ability and skill would excel in a test of this type over the workers who were employed for jobs requiring less skill.

The mean scores of the twelve workers with an education rating of one was slightly lower than the mean scores of the nine workers with an education rating of two, but six of the male workers were included in

the first classification. There were only two workers, both women, who had an education rating of three. The mean scores for these two workers were not as high as for women workers who had an education rating of two or one. Other factors than formal education would appear to have affected the scores. The number of workers was small, and the range of scores within a classification was large; there is not sufficient evidence to draw any conclusion in regard to the relationship between education rating and test scores.

Table 12. Mean pre-test and post-test scores, classified according to sex and education rating

Sex	Education rating	Number of employees	Mean pre-test score	Mean post-test score
M	1	6	11.0	15.8
F		6	24.0	26.8
Total		12	17.5	21.5
M	2	1	17.0	10.0
F		8	24.9	26.1
Total		9	24.0	24.3
M	3	0	-	-
F		2	20.5	18.5

Interpretation of tests, individuals or sub-groups of individuals

Some interpretations of outcomes can be made on the basis of individuals or sub-groups of individuals. Except for one paragraph concerning the workers who did not attend the training classes, the following interpretations are made in regard to individuals or sub-groups

among the 23 workers who attended the training classes.

Employees who participated in or had direct contact with work process studies. One may question whether the 13 workers, who participated in or had direct contact with the eight studies of work processes conducted in the kitchen and dining room, made higher test scores than the workers who were not concerned with these studies. These workers will be referred to as the participation group, and the remaining 10 workers as the non-participation group. The mean test scores for the participation and the non-participation groups are shown in Table 13.

Table 13. Mean test scores for the participation and non-participation groups of employees

Group	Number of employees	Pre-test		Post-test		Re-test	
		Test I	Test II	Test III	Test IV	Test I	Test II
Participation	13	8.62	14.69	14.77	12.46	13.77	19.23
Non-participation	10	7.10	9.30	8.10	7.70	13.40	13.30
Total workers	23	7.96	12.35	11.87	10.39	13.61	16.65

The participation group's mean scores were higher than the non-participation group's mean scores for each test. The differences between the means for each test were as follows:

Pre-test		Post-test		Re-test	
Test I	1.52	Test III	6.67	Test I	.37
Test II	5.39	Test IV	4.76	Test II	5.93

It should be realized that the participation group included all of the 13 main kitchen cooks except one, whereas the non-participation group in-

cluded the seven male workers who held the jobs demanding relatively little skill. This fact rather than participation in the work process studies may account for the appreciable difference between the mean scores of the two groups. A comparison of the scores for the pre-test, given before any of the work process studies had been initiated, substantiates this interpretation. Because of the differences between the two groups other than the fact that they did or did not participate in work process studies, it is not possible on the basis of this comparison to substantiate any statement in regard to the effect of participation on the performance of the workers on the tests.

During the work simplification classes and work process studies, a record was kept of comments and suggestions made by the employees. When the comments and suggestions made by the two groups were compared, it was evident that there were very few comments made by the non-participation group, whereas many of the participating group made several suggestions. Here again, however, the possible reasons are confounded. One could certainly not conclude that this difference was due to participation. Reasons noted in the previous paragraph in regard to the test scores of these groups may apply here. Other contributing factors may include the following: First, some of the workers in the participating group who made the most suggestions were usually in one of the classes in which there were only a few workers, and as previously noted, there were often more contributions from the workers in the smaller classes. Second, most of the examples used in the classes were directly related to production and service of food which was the work, to some extent, of all of the

participation group, whereas seven of the non-participating group worked as a pot washer, dish washer, or porter. Third, the author had more out-of-class contacts with the participating group; hence there was more opportunity for her to receive suggestions informally.

Employees' familiarity with content of tests. One may ask whether employees who were very familiar with the work process depicted in a given situation test did relatively better on that test than on other tests or better than other workers on the same test. Employees No. 5, 17, and 19 often made sandwiches in quantity, the work process shown in test II. It is interesting to note in Table 14 that two of the workers' scores for

Table 14. Test scores of three employees familiar with the work process in test II

Employees' number	Pre-test		Post-test		Re-test	
	Test I	Test II	Test III	Test IV	Test I	Test II
5	10	9*	16	16	14	34
17	6*	11*	15	17	17	19
19	6*	13	16	10*	15	17
Mean for 23 employees	7.96	12.35	11.87	10.39	13.61	16.65

*Below the mean

test II, when taken as a pre-test, were below the mean for the total group, and the other score was only slightly above the mean. The scores for the 23 workers varied from 2 to 26. All three of the scores for test II on the re-test exceeded the mean, although two were only slightly above. It will be recalled that one of the examples in the training class and

one of the work processes studied was that of sandwich making, which was the job depicted in test II. These workers had participated in this study, and worker No. 5 was unusually enthusiastic about some of the changes introduced during the process of the study. In fact, after one of the classes she initiated one of the changes in the work process. She made the highest score in the group when test II was given as a re-test. Her gain of 25 was the greatest gain made by any worker between a test on the pre-test and the same test on the re-test. One reason for her enthusiasm was the fact that some of the recommendations made in the classes substantiated her preconceived ideas about the work process.

Employee No. 2 was responsible for the job depicted in test III, eyeing potatoes, and she made her highest score on this test. Her scores on the tests were as follows:

	<u>Test</u>	<u>Employee's score</u>	<u>Mean score</u>
Pre-test	I	4	7.96
	II	7	12.35
Post-test	III	16	11.87
	IV	9	10.39
Re-test	I	13	13.61
	II	9	16.65

On all other tests except III worker No. 2 had scores below the mean. This was rather surprising, for she excelled in making suggestions of merit both in the classes and in the kitchen. She seemed to be very interested in improving her methods of work in any way she could.

Workers No. 5, 17, and 19, whose scores are shown in Table 14,

sometimes performed the job presented in test III. Their scores on test III exceeded the mean and were comparable to the score made by worker No. 2. Two workers made scores higher on test III than any of the four workers who performed the job depicted in the test.

These particular cases are not in accord regarding whether or not close familiarity with a task is an advantage or disadvantage to seeing ways in which a task may be simplified. Perhaps a worker can make more suggestions if techniques observed vary from those which she has experienced. It may be that the habits of work established may inhibit thinking of alternative methods. The increased score of worker No. 5 for test II does suggest, however, that a worker may learn a great deal when application of generalizations are made to a situation in which she is actually concerned.

Employees in relation to total distribution of scores. An analysis was made to determine which workers made the highest total scores when their six test scores were combined. Following is a distribution of the total scores of the 23 workers:

<u>Classification of scores</u>	<u>Number of employees</u>
100 - 109	3
90 - 99	3
80 - 89	2
70 - 79	5
60 - 69	-
50 - 59	5
40 - 49	4
30 - 39	1

The distribution is binomial in character. Of the qualities studied, the one which was common to the three employees, No. 14, 8, and 18, who had the three highest total scores, was their verbalization rankings, 19, 9, and 16. (The limits of the range of composite verbalization rankings for all 23 workers was 5 through 70. The one considered least verbal had a ranking of 70.) The women workers in the lowest three classifications, No. 10, 3, and 2, had composite verbalization rankings of 41, 58, and 44 respectively. The skill required was approximately comparable for the jobs held by these three workers and the three who had the highest scores.

Even though there was not a significant correlation between the verbalization rankings and the test scores, as shown in an earlier section, the consideration of these particular cases suggests the possibility of some relationship that may need further investigation in the future.

The three women cited in the first classifications of scores and also the three in the three lowest classifications had participated in or had contact with the work process studies. Two of these workers, No. 18 in the first classification and No. 2 in the sixth classification, were among the four workers judged by the author to make the greatest contributions to group discussions in the training classes.

Employees' attitude. The attitude of the workers at the time they took the tests was believed to have affected the responses they made. Employee No. 4 was the only worker who apparently objected to taking the pre-test. His scores on this test were relatively low, four and seven.

He seemed to be somewhat uncooperative when taking the post-test; his scores were likewise low for this test, four and six. He was much more cooperative when taking the re-test, and the increases in scores over his previous scores for the same tests were 11 and 3. Workers No. 9 and 13 were disgruntled during the administration of the post-test, and their attitudes may have had an adverse affect on the scores of their tests. Observation of these two workers in other situations indicated that the negative attitudes expressed were not peculiar to the test situation.

Employees who did not attend training classes. There were three workers to whom some or all of the tests were administered, but who did not attend the classes. Personal data were secured for two of these workers. Worker No. 24 was a college graduate and had had considerable work experience, particularly in the work process depicted in test II. His score on all tests exceeded the mean of the entire group, and for test II, when given as a pre-test, and test IV exceeded those of any other worker. When tests I and II were administered as a re-test, he increased his score for test I by six points but made no increase in his score for test II. When workers No. 25 and 26 took test I for the second time, worker No. 25 increased her score by one point, but worker No. 26 made the same score. When test II was taken for the second time, workers No. 25 and 26 had a lower score than previously, five and three points lower respectively. The mean gains for tests I and II when taken by the group of workers who had attended the training classes were 5.6 and 4.3 respectively. In general these three workers did not appear to do as well on the re-test as the workers who attended the work simplification

classes; this would give some additional evidence to suggest that the workers benefited from the classes.

Changes in Methods of Work

The eight work process studies indicated that some progress was made in improving work methods during the work simplification program. Descriptions of these studies were given in an earlier section. Workers' suggestions, whenever practical, were incorporated into the improved methods developed. For some work processes the improved method resulted in a decrease in labor time; in many instances, however, the main achievement of the improved method was to make the work easier for the worker. Three of the studies did not result in improved methods being effectuated, but suggestions were made of possible ways for improving the methods used.

In instances where the improved method resulted in a decrease in labor time, the labor cost could be decreased for the particular work process. It must be remembered, however, that the decrease in the work time for one operation does not result in a decrease in actual labor cost unless the paid labor time is decreased or unless a greater volume of work is achieved with the same labor.

In the present research attention was paid particularly to the classes of changes¹ which workers could make to improve methods of work that are determined by them. Although several of the work process studies made were chiefly concerned with changes in hand and body motions,

¹See Mundel's classification of changes on page 52.

the results of observations emphasized some of the major determinents of the efficiency of the total operation, namely: the individual menu items, the combination of menu items, the over-all organization of the work, the scheduling of the workers, the provision of foods and supplies in adequate amounts and at the times needed, the provision of the best quality of a food in relation to a particular use, the provision and location of large and small equipment, and the layout of individual workplaces and the entire food service unit. One example of the importance of equipment and layout of the work area was provided by the study made of machine peeling and hand finishing potatoes. This study, likewise, exemplified the effect of quality or kind of food. It is believed that major improvements could be made in this process by changing the physical facilities and the type of potatoes used. Another example observed was the disruption of work activities in instances when the foods to be used in the preparation of a meal were not available at the time needed.

Some work simplification programs for employees in mass production repetitive industry include consideration of all classes of changes and some type of formal suggestion system. A notable example of such a program is that in effect at the Maytag Company (37). A comprehensive program of this type might be developed for food service employees; the approach, however, would probably be somewhat different than that used in a repetitive industry.

The anticipated follow-up of the work simplification training program for workers, as exemplified in the present research, is that there will be a continuing program of work simplification and that the person re-

sponsible for methods improvement will work with the individual workers in making any changes which affect their work. It should be remembered that the primary objective of work simplification training for workers is not to develop skill in improving methods, but rather to provide an understanding and develop attitudes which will facilitate the process of methods improvement.

Reactions of Employees

The workers who were affected by the work process studies gave excellent cooperation to the author during the periods that the work methods were being analyzed and improved methods developed. In addition, the workers who were asked to adopt new work methods, recommended as a result of these studies, were observed using the methods during the latter part of the research project. Individual instances are described in an earlier section. It would be valuable to determine to what extent these methods continued to be used after the conclusion of the project.

On the basis of the data obtained, it is not known to what extent the cooperation extended by the workers was a result of the work simplification classes and procedures used during the training program. In the opinion of the author, good morale existed among the workers, and the workers were, in general, capable and conscientious. They appeared to have considerable pride in their work, loyalty to the institution, and respect for the supervisory staff and top management.

These opinions in regard to the group of 23 workers were corroborated

by the five supervisors' ratings of the workers.¹ Twenty workers were rated as being pleasant, cooperative, and dependable. Most of the supervisors indicated the quantity and quality of the work done by all but three of the workers as satisfactory. Only one worker was known to be dissatisfied in her work. Only four of the 23 were considered not sufficiently ingenious to meet emergencies; conversely, many of the other workers not only were able to meet emergencies, but often made good suggestions for improving work. Twenty-one of the employees were considered by the majority of the five supervisors to expend normal effort in performing their work or were considered to work with ease. Undoubtedly such a group of employees would be more likely to cooperate in a work simplification program than a group in which high morale did not exist.

The fact that management indicated its support of the training program is believed to have been an important influence in assuring the cooperation of the group. Greater accomplishments could probably have been realized, however, if there had been more active participation by the supervisors in the program. There was some evidence, too, that the supervisory group did not clearly understand all of the objectives of the program, for example, that one of the objectives was to stimulate employees to make suggestions for improving work methods. This unawareness was perhaps due to the fact that this objective was not made clear. If this were the case it would certainly need to be corrected in any subsequent program patterned according to the present program. It is very probable that the four group conferences held with the supervisors

¹A copy of the rating scale is in Appendix A.

were insufficient to provide the necessary background of information for the program.

Suggestions

One of the objectives of the training program was to stimulate employees to make suggestions for improving work methods. Employees did make suggestions, both in the classes and during the work process studies. The experience in the present research was similar to that in Hudson's (17) study in that workers frequently made suggestions in regard to the equipment and other facilities. The suggestions of this nature made in the present study, however, evidenced an understanding and appreciation of management's problems in providing facilities.

Hudson reported that many of the individuals with whom he worked in the nursing service of a hospital believed their work was unique in respect to work planning and execution and that they had worked out as good methods as could reasonably be expected. This attitude was not apparent in the present study to any degree; in fact, some workers often made such comments as "There is always a better way."

Evaluation of the program

At the end of the individual conference at which the post-test was administered, each employee was asked if he had made any changes in the way he did his work since he attended the seven classes on work simplification. If the worker said that he had, he was asked to describe the changes.

Eleven of the workers gave one or more specific examples of changes in their methods of work. In the majority of cases the changes were those recommended as a result of the work process studies. One qualified her statement by saying that the methods were not new to her, that she had used the methods previously.

Of the remaining 12, one employee did not cite any specific change that she had made as a result of the classes, but the author knew from contacts with her in the kitchen that she had tried to work out improved techniques of doing her work; this was true even before the work simplification program was begun. Another employee said she had made no changes; she was the one, however, with whom the study of the method of cutting grapefruit was done. The worker was reminded of this change, and she concurred that she had changed that method. Ten employees reported that they had not made any change in their work methods.

The workers were also asked to evaluate the seven work simplification classes. They were urged to give their frank opinion regardless of what it was. Four were very enthusiastic about the classes and stated that they were worthwhile. Following are the comments of two of these workers:

I really enjoyed those pictures. They were worthwhile. I missed them after we didn't get to go. I looked forward to them. It was good to see how things were in other kitchens.

Was awakened to lots of things, as that we make unnecessary steps. Showed that we could do the same job with less effort. Learned things from the films. I was doing some of the things that were on the film. I have tried to better it myself. A person doesn't get so tired.

It is of interest to know that the worker quoted first was one who had made no change in her work as a result of the classes. In the opinion

of the author the classes were a source of entertainment rather than instruction to this employee. This is believed to have been true for some of the other workers as well.

Fourteen additional workers indicated that they thought the classes were interesting and beneficial. An example of a comment made by one of these employees was as follows:

I believe they were beneficial to a worker. You can see the way other people have done. A person working likes to find out how he can do the quickest and easiest.

Five of these workers' comments did not denote as much enthusiasm as those of the other nine, but in general their reactions to the classes were favorable.

Two of the workers gave no definite opinion in regard to the classes, and three said that the classes were of no value to them. Two of this latter group were employees who have been described previously as having a negative attitude throughout the conference at which the post-test was administered.

Discussion of Outcomes and Problems in Relation to the Purposes of the Research Project

Selection, development, and use of visual materials

One of the four purposes of the research, as given in the Introduction, was to select appropriate available visual materials and to develop additional visual material for training food service employees in work simplification. Very few visual materials which were suitable for in-

clusion in the program were found to be available. Evaluations of those selected are included in the description of Visual Materials and the Work Simplification Courses. Colored slides and an illustrated booklet were developed and used.

The motion pictures and the colored slides facilitated the presentation of information and would seem to have aided learning although the design of the research problem did not afford any objective evidence in regard to the latter point. Certainly the motion pictures and colored slides engendered the interest of the group. In addition, use of these visual materials is believed to have decreased the time needed to present information in the classes. In the opinion of the author, it would not have been possible to have had as clear communication in the classes without the use of these visual materials unless actual demonstrations or other visual means were used.

To what extent the illustrated booklet developed was effective in promoting learning is not known. The booklet seemed to be a valuable aid in the conduction of the classes, but it did not appear to be as important as the motion pictures or colored slides in aiding the process of communication between the trainer and the workers. A chalk board or simple posters could possibly be used as effectively as such a booklet.

A second purpose of this research was to plan and try out work simplification training for a group of food service employees using the visual materials selected and developed. The use of visual materials in a work simplification training program represents one approach to this type of training. Those materials used in this research, except for one

of the motion pictures, are appropriate for inclusion in classes similar to the ones conducted in the present study. Slides of the type developed could be made by an amateur photographer in any food service organization. The photography is quite time consuming; hence, it would be advantageous if visual materials needed could be purchased or secured on loan for use in a training program. Based on the experience of this study and other work simplification programs reported in the literature, the use of colored slides or black and white prints to depict work situations before and after improvement of work methods may be expected to promote interest in any work simplification program.¹

Two problems that may be encountered in the use of visual materials as employed in the present research should be recognized. One has to do with the equipment and facilities necessary to use visual materials. For motion pictures and colored slides a screen, appropriate projectors, and

¹In addition to the use of such visual materials for a work simplification training program in a specific food service organization, they may be employed for teaching students preparing to become dietitians or food service managers, for vocational food service classes, and in short-courses and refresher training offered for food service workers. It is expected that the motion pictures developed of work situations in quantity food service will also be of use for purposes other than testing as they were used in the present research. They may be employed in various ways in work simplification training for students preparing for food service work or for food service supervisors or employees. They could serve to present work situations for analysis on a process chart or an operation sheet, or they could be presented as a basis for discussion of work methods and possible ways of simplifying them. Since the work methods depicted are inefficient, it might be desirable to film the same work processes with improved work methods so that the two methods may be contrasted.

Additional visual materials need to be developed for training food service workers in the area of work simplification and in other areas such as quantity cookery and the use and care of equipment. It is believed that the use of such visual materials will facilitate training both by developing and holding the interest of the trainees and aiding the process of communication between the trainer and trainees.

a suitable room are needed. Standardization of the type of visual materials used simplifies the problem of equipment and facilities. In this research a 16 mm. motion picture projector and a slide projector for 2 x 2 slides were used. Advance planning is necessary to assure having the necessary equipment and facilities. It would seem advisable for the person conducting the training classes to learn how to operate the projectors so that it would not be necessary to secure the services of an operator each time a projector is used.

A second problem encountered, regardless of whether visual materials are used, is that of scheduling classes. In many food service organizations it is difficult to schedule classes at a time when most of the workers can attend. In the present research project, a special effort was made to include all of the 23 workers in each of the seven classes; it was necessary, therefore, to repeat each class three times. The number of workers per class varied from one, in one instance, through 16. Probably the optimum number of workers per class from the standpoint of group participation is 10 through 15, although groups as large as 25 could be used. In the present program the best group discussions occurred in small groups of eight or less in which most of the employees were food production workers. It is not known whether the participation was due to the fact that most of the material presented was related to food production, that the groups were homogeneous in regard to type of work, that the groups were relatively small, or to the individual interests and abilities of the workers.

It is believed that if those responsible for the organization of the work and the planning of work schedules were also responsible for

the training classes, adjustments could be made so that all employees could attend classes at one time. If there is a large number of employees, however, it would be preferable to repeat the classes in order to keep the groups relatively small to facilitate group discussion. In school or college food service the solution may be to concentrate class training at the beginning of the school year and during school vacation periods. An attempt to meet the scheduling problems involved should be made since it would seem that group training can be more economical of time and in some ways more effective for certain types of training than doing all of the training on an individual basis even though some individual training is necessary.

Since spaced learning is generally conceded to be more effective than massed learning, it would seem desirable to extend the classes over a span of at least a few weeks. In the present program the seven classes were conducted over a period of three and one half weeks. It may be equally as effective to extend this number of classes over a seven week period. In either case periodic follow-up or refresher classes over a longer period of time would be desirable to reinforce the learning. If class training is concentrated during vacation periods, as in school or college food service, it may be necessary to present the information in classes during a period of two or three days. A follow-up to such concentrated training should be made by continual application of work simplification generalizations in the work situations and by subsequent refresher classes.

The length of a training class for food service workers should prob-

ably not be shorter than 30 minutes, as used in the present program, or longer than one hour. A minimum of 30 minutes is needed to develop an idea and allow some opportunity for group discussion. A class longer than this may be more difficult to fit into the employees' schedules. Since food service workers are not accustomed to sitting for long periods, any single class should probably not extend over an hour, and a class of this length should include some participation on the part of the workers.

If a class period is 30 minutes long, motion pictures or filmstrips should preferably not be longer than 15 minutes in order to have adequate time for interpretation and discussion before and after the film presentation. Two of the motion pictures used in the present program were much too long for most effective use in a 30-minute class. As indicated in an earlier section, one of these films was considered inappropriate in content as well as in length. Use of the colored slides was very effective in communicating ideas and stimulating group participation because it was possible to discuss the points presented between the showing of the slides.

The author is of the opinion that, considering the scope of information presented and the visual materials used, the classes would have been more effective if there had been additional class time. Seven 45 minute classes or 10 classes of 30 minutes would seem to have been more satisfactory.

Visual materials directly related to work in a food service unit are probably most effective in facilitating learning. In the present research some pictures not directly related to food service were used, however,

and were considered quite effective. Two of these films were "Motion Study Principles" and "Damp Dusting."¹ Both were too long for best use in a 30-minute period, but each film clearly presented certain work simplification generalizations and their application.

An alternative visual approach to training food service employees in work simplification is the use of demonstration. Trainees in Vander Meer's (68, p. 89) experiment rated "teacher demonstrations and actual work on the machines" superior to motion pictures in helpfulness in learning. In addition, the author has observed work simplification generalizations very effectively taught by the use of demonstration. Certain problems in the use of this technique are apparent. First, considerable time is necessary to prepare the properties needed for such demonstrations; second, special skill is needed in order to perform demonstrations effectively; and third, the scope of activities that can be demonstrated is more limited than that which can be presented by the use of visual materials such as motion pictures or colored slides.

Research methodology

A third purpose of the present research project was to provide a basis for recommending methods of research for similar studies. In order to make recommendations it is necessary to review some of the problems involved in evaluating training procedures and then to consider the specific problems encountered in the present project.

Relatively little research has been done to determine the effective-

¹A list of motion pictures is in Appendix A.

ness of different training procedures, and few techniques have been developed for evaluating outcomes. In most instances where evaluation has been attempted, objective results were available as one basis for evaluation. For example, one criterion used by Vander Meer (68) was the length of time required to do a specific lathe operation. McGehee and Livingstone (31, 32) evaluated a training program on the basis of the percentage reduction in waste which resulted. The effectiveness of using a filmstrip in a school situation has been compared by administering written tests before and after presentation of information to two groups, one of which received the information from a filmstrip and one from printed material (54, 74). Another type of evidence which has sometimes been used is opinions of the trainees or trainers regarding the effectiveness of the methods, but the reliability and validity of this type of evidence may be questioned. The opinions of the workers in regard to the effectiveness of the classes were solicited in the present study as one type of evidence to be used in interpreting the outcome although the limitations of such evidence were recognized.

In some circumstances it is desirable to measure results such as attitudes and understanding. In the present research, in addition to certain other methods which were used to collect information to determine outcomes, an attempt was made to develop tests which would give objective evidence of the workers' understanding of work simplification generalizations. The assumption was made that in order to achieve the objectives of work simplification training for employees¹ it was necessary to in-

¹See objectives of work simplification training for employees in the Introduction.

crease the workers' understanding of work simplification generalizations.¹ In order to determine the effectiveness of the training program in increasing the understanding, situation tests were developed. One consideration in planning the tests and their administration was to eliminate the effect of any differences among the group in ability to read and to express ideas in written form; hence, the situations were presented by motion pictures, and the responses made by the workers were given orally.

The results of these tests were not needed to determine other expected outcomes of the training,² but for purposes of the present research it was considered desirable to have some evidence of whether there was increased understanding as well as the other outcomes. If increased understanding of work simplification did not parallel the accomplishment of the other objectives, one might hypothesize that the achievement of the other objectives resulted only from the additional attention paid to the group or that the conditions, relative to the employees, defined as objectives for the program existed before the program was begun.

In the process of the research certain problems arose relative to the use of the situation tests. Two problems encountered were the amount of time necessary to administer the tests and to score the responses. Descriptions of the administration of the tests and the procedure for scoring have been given in earlier sections. Another problem encountered

¹This assumption may be questioned, but in order to determine the validity of the assumption in some future study it would be necessary to develop some means for evaluating understanding. Any progress made in the present research in that respect, therefore, might be applied to determining the validity of the assumption.

²See objectives of work simplification training for employees in the Introduction.

was that of not knowing the relative difficulty of the tests for the particular group of workers. An attempt was made to determine the difficulty by administering the tests to a group of students who did not receive any instruction between the tests. As the research progressed it was recognized that the group of students was too small to make any conclusions and, in addition, that the relative difficulty of the tests for a student group might not be the same as for the group of food service workers. On the basis of these problems it appears that the situation tests developed were not entirely satisfactory as instruments of evaluation.

It seems that further investigation should be made in another study of using motion pictures as a technique for presenting a test situation in circumstances where the individual's ability to read makes presentation of test situations in printed form impractical. The oral response technique would also seem to warrant further consideration in circumstances where the individual's ability to express ideas in writing may bias the results. In order to make the tests more satisfactory, the relative difficulty of the tests would need to be determined and the techniques for administering and scoring simplified. The validity and reliability of the tests should likewise be determined.

With the experience of this research project as background, it is of interest to consider how the four situation tests developed might be further perfected. One complexity in the use of the tests was due to the fact that alternative responses for improvement of the work methods are possible and that one response may be more valuable than the other

in relation to the possible resulting savings in time and/or energy. One person may make a suggestion which would decrease time and/or energy by 20 per cent whereas another suggestion in regard to the same point may decrease time and/or energy by 50 per cent. Another problem became apparent too in the administration of the tests; that is, that once a person gave a suggestion which in his opinion was the best suggestion, he seemed less likely to give alternative suggestions which were in his opinion less desirable.

One step toward the solution of these problems of administering and scoring the tests might be to require the individual to choose from the suggestions which he made in relation to a particular point the one he considered best. By determining in advance the relative merit of possible suggestions, scores could be assigned to the various suggestions given in relation to their merit. In the scoring procedure used in the present study, there was an attempt to determine the merit of suggestions made regarding the application of work simplification generalizations; however, scores were given for alternative suggestions.¹

If the responses were scored on the basis of the relative merit of the suggestions, the scores received on each test would represent the relative value of the suggestions in terms of time and/or energy to be saved but would not necessarily reflect relative difficulty. It might be easier for a worker to give a suggestion on one test which decreased the time and/or energy by 50 per cent than to give another suggestion which would decrease the time and/or energy by only 10 per cent; that is,

¹See the section Procedure for Scoring the Situation Tests.

some very desirable solution may be easier for the worker to propose than some less desirable. To determine the relative difficulty of the tests, they would need to be administered to a large number of individuals comparable to the group for whom the test was to be used as an instrument of evaluation. Then the number of times each possible suggestion was given could be used as a basis for establishing the relative difficulty.

An alternative plan for using the tests to determine the results of training would be possible if a larger number of employees were available in one institution or in similar institutions. With this plan it would not be necessary to determine the relative difficulty of the tests in advance of their use as an evaluation instrument, for the information would be afforded as a result of the design of the experiment. Assume there are only two tests, T_1 and T_2 (tests I and II may be considered T_1 and tests III and IV, T_2). Group A, the control group, would not receive training between the administration of the tests; group B, the experimental group, would receive training between the administration of tests. Both groups A and B would be divided into four sub-groups at random and the tests would be administered as indicated below:

Group A (Control)		Group B (Experimental)	
<u>Pre-tests</u>	<u>Post-tests</u>	<u>Pre-tests</u>	<u>Post-tests</u>
T_1	T_1	T_1	T_1
T_1	T_2	T_1	T_2
T_2	T_2	T_2	T_2
T_2	T_1	T_2	T_1

The control group and the experimental group would need to be comparable. The size of the groups and sub-groups needed in order to secure reasonably reliable results would need to be determined. Care should be taken that workers do not learn of the content of the tests in advance of their administration. Work process studies would need to be made in both groups to determine the extent to which workers were receptive to analysis of their jobs, to methods proposed, and to adoption and use of methods prescribed. As in the present research, it would be preferable if the same person could conduct all of the classes and if the same person or persons could make all of the process studies.

In the above proposals some problems still exist. One is that it is not known what the effect of a worker's familiarity with the work process depicted in a test might be. Does familiarity inhibit the worker's responses if the methods which he knows are similar to those which are depicted, or does it inhibit response if the methods he knows are different than those depicted? If a worker is completely unfamiliar with the work process, is he at an advantage or disadvantage on the test? One possible solution to this problem might be to present hypothetical work situations not related to food service or work situations with which none of the workers would be familiar.

A practical problem that would arise is securing a large enough number of workers, for among workers from different food service units there would be many variables which might cause variation in responses. Some of these variables include the following:

Among work groups - the type and volume of food service, facilities and equipment, methods of supervision, the morale of the group, and the work load.

Among individuals - the sex, age, intelligence, kind and amount of experience, training, educational level, habits of verbalization, interests, attitudes, personality, and present work of the employees.

Based on analysis of the group of 25 workers in the present research, the evidence did not support the hypothesis that there was a relationship between age, experience, habits of verbalization, or educational level of the employees and the results on the situation tests, but the evidence did suggest that sex and/or present work may have been factors related. Consideration of the data on the basis of sub-groups or individuals suggests that habits of verbalization may have been related to the results on the tests. The difference in sex was confounded with present work, but it was believed that present work was more likely to be related to results on the situation tests than sex. The group of workers in the present study was too small to draw conclusions in regard to the effect of any of these variables.

The most comprehensive recommendation found in the literature in regard to methodology for determining the effectiveness of training methods was that given by Ryan. He outlined the following procedures (60, p. 299-300):

1. Determination of the best method of performing the work; that is, finding out in detail what is to be learned. . . .
2. Determination of the sequence in which the aspects of the job are to be taught, ignoring the traditional method of teaching, and considering experimental information which might have a bearing upon the ease of learning the materials in various orders and in various methods of subdividing the job.
3. Drawing up a detailed teaching and practice plan. This plan would contain:
 - (a) Descriptions of the instructor's technique in introducing the worker to each phase of the job.
 - (b) Scheduling the practice sessions, including their duration and spacing, and the type of practice which is to be carried on during each session if possible.
4. Explicit provisions for motivating and developing interest. . . .
5. Selection of a suitable measure of proficiency. . . .
6. Provision of a control group to be trained by former methods, or by other methods under consideration. The control group of workers should be as nearly identical with the experimental group as possible in each of the following qualifications:
 - (a) age,
 - (b) aptitude for the work,
 - (c) interest and ambitions,
 - (d) education and previous experience.(Frequently, matched pairs of individuals, one in each group, provide for more reliable results. In any case the assurance with which conclusions can be drawn will depend upon the size of both the experimental and control groups.)
7. Statistical analysis to establish the differences in achievement resulting from the experimental and control methods.
8. Analysis of the types of error, points of special difficulty, and bottlenecks which appear in the performance of the trainees during training under each method. . . .

Ryan emphasized that the program outlined above is ideal and that it would probably never be possible to follow exactly.

Many of the procedures recommended by Ryan were followed in the present

research. A comparison between Ryan's points of procedure and those in the present research is given below:

1. Consideration was given to what work simplification generalizations needed to be taught food service employees.
2. Consideration was given to the sequence of presentation, and the method of presentation was developed on the basis of findings in the literature and known techniques that were considered to be effective.
3. The teaching plan for the work simplification classes was developed, and the work process studies were arranged to exemplify the application of work simplification generalizations.
4. Incentives for learning for the group of employees were taken into consideration.
5. Various means were used to measure outcomes, such as observation of the receptiveness and cooperation of the workers, record of suggestions and comments of the workers, the workers' subjective evaluations of the program, the work process studies made, and the results of the situation tests.
6. The present study was exploratory in nature; it was beyond the limitations of the study to have a control group. Information was collected about the experimental group, however, as a basis for interpreting some of the outcomes. The situation tests used as one means of evaluation were administered to a group of students as well as the workers in the belief that the students' scores might be used to indicate the relative difficulty of the tests. The number of workers

in the experimental group was too small to make reliable interpretations of results.

7. Statistical analyses were made of the data available.
8. Analyses were made for sub-groups and individuals. Unexpected developments were recorded.

Ryan's (60) suggestion of matched pairs of individuals between the experimental and control groups provides another approach to the design of the experiment.

A limitation of the present research was that only work processes which could be analyzed by one observer could be used as a basis for process studies. Since many of the work processes were dovetailed among several workers and were often not in repetitive cycles, they could not be recorded as a basis for analysis and improvement. It would, therefore, seem desirable to have more than one researcher available when needed for analysis of certain work processes or to take motion pictures of these processes and make the analyses from the pictures.

It was evident from the present research that sufficient time must be allowed for observation and analysis to observe work activities in a variety of combinations. What appeared to be a desirable change in one work situation was sometimes found to be impractical because of conditions resulting from different menu combinations to be produced and served or different volumes of production. Orientation to the entire cycle of work activities, from the opening of the food service in the morning until closing at night, was found to be a valuable background for analysis of

specific work processes.

A limitation of the present research was that not all the workers who attended the classes participated in or had direct contact with work process studies. Although it was not possible to conclude on the basis of evidence from the present project that this factor made a difference in regard to the effect of the training program on the worker, it is believed that the learning of each worker will be more effective if application of work simplification generalizations is made to a work process with which he is concerned. In addition the installation of an improved method is necessary in order to determine the worker's reactions to the process of analysis and his receptiveness to methods prescribed. It would, therefore, be recommended that, in any investigation similar to the present research, process studies be conducted which will affect all of the workers.

When the work simplification classes are being used to train workers in other than a research investigation, ways of improving work methods should be developed, but the need for including every worker and the need for precise analyses are not as important.

In regard to management research methodology, one may summarize as follows: To determine the effect of any treatment such as a method of training, other factors being constant, the results will be more reliable if the individuals selected to receive the treatment are as homogeneous, in regard to any factors which might possibly influence the results, as can be obtained; results will also be more reliable if a group, as nearly comparable as possible, which does not receive the treatment, is used as

a control; and other factors being constant, the larger the research group, the more reliable will be the results. In order to have a valid experiment there should be randomization of assignment of treatments. In the case of an experiment designed to evaluate the effect of training, the experimental unit, to which the treatment is assigned, would probably need to be a group of employees rather than individual workers. Another qualification in the design of the experiment is that it should afford reasonable precision and there should be evidence as to how precise the estimates or conclusions are. In so far as possible there should be control of or measurement of all variables existing within or among the experimental units. These conditions are applicable to any area of research, and should be held as a goal in social science research even though the problems of identifying, eliminating, controlling, and measuring variables often appears to be unsurmountable.

Proposed assumptions and hypotheses regarding training of employees

Another purpose of the present research was to formulate hypotheses regarding the training of food service employees and specifically in regard to the use of visual materials for teaching principles of work simplification. Proposals in regard to research methodology are included in the preceding section.

On the basis of experiences and recommendations reported in the literature and the experiences and outcomes of the present research, certain generalizations in regard to training appear to be accepted. It seems appropriate, therefore, to propose such generalizations as

basic assumptions. Other generalizations, which need further investigation before acceptance are formulated as hypotheses. When reference is made in the assumptions or hypotheses to a work simplification training program for employees, it is assumed that the program has the objectives which are given in the Introduction.

Assumptions:

1. A training program designed to change the skills, attitudes, and/or interests of employees is more successful in achieving such changes if it has the support of top management and the active support of the levels of management to whom the employees are directly responsible.
2. A training program is more effective if the representatives of management to whom the employees are directly responsible participate in the administration of the training program.
3. A professional teacher from outside of the organization may be used to advantage in a training program for employees, but management should have responsibility for the training program.
4. A training program is more effective if management representatives to whom the employees are directly responsible have a thorough understanding of the skills, attitudes, and/or interests proposed to be developed in the training program for the employees.
5. A training program is more successful if designed to fulfill a need.

6. If the need for training is not recognized by the employees a training program is more effective if it provides for developing a recognition of need.
7. The objectives of training are more likely to be achieved if interpreted to the employees in terms of their personal incentives for learning.
8. Visual materials developed for use in a training program are most effective if they are so executed that the ideas intended to be conveyed are clearly and forcefully presented.
9. Visual materials are most effective if they are designed to convey a specific idea or ideas, if basic principles of color and/or design are applied, and if conditions or elements which distract from the intended purpose are eliminated or minimized.
10. By the use of classes, training may be provided that would not or perhaps could not be accomplished by individual on-the-job training. Class training is purposed to supplement, not replace, individual training. For food service employees to receive part of their training in group meetings or classes, careful advance planning is necessary.
11. Employees are more likely to accept and cooperate in an experimental or training program if the program is so introduced that the importance of the workers' participation is recognized and the workers' security is not challenged.
12. A work simplification program is most effective if one person on the management staff within an organization or division of

the organization provides leadership for simplifying work methods and all members of management and labor support the program.

13. In a work simplification program, the services of a specialist in work simplification or methods improvement may be used to advantage to analyze work methods and help develop improved methods. The support of all members of management and labor is necessary for effective utilization of such a specialist.
14. A work simplification training program for employees is effective only if management is willing to give objective consideration to the suggestions of employees.

Hypotheses:

1. If such visual materials as appropriate motion pictures and colored slides are available for training food service employees in work simplification, their use is more economical of the trainer's time and is as effective as actual demonstration to teach work simplification.
2. The proper use of appropriate visual materials in work simplification classes for food service employees facilitates communication between the trainer and the employees, decreases the time necessary for training, and helps to gain and hold the interests of the employees in the training program.
3. The use of visual materials to depict work situations before and after improvement of work methods promotes interest in a work simplification program.

4. Visual materials used in work simplification training for food service employees are most effective if they illustrate the application of work simplification generalizations in the types of work which are performed in a food service operation.
5. Work simplification training for food service employees is effective with workers who have low morale as well as with workers who have high morale.
6. A work simplification training program for food service employees is one means of contributing to harmonious management-labor relations.
7. Provision in a training program of an understanding of work simplification by food service employees is one means for contributing to harmonious management-labor relations because it provides workers with additional understanding of management problems and it provides a means whereby employees may contribute to management decisions which affect the employees' work.
8. By work simplification training food service employees become more receptive to analysis of their jobs, to work methods proposed by management, and to adoption and use of the methods prescribed.
9. By acquiring an understanding of work simplification in a training program, food service employees become more receptive to analysis of their jobs, to work methods proposed by management, and to adoption and use of the methods prescribed.

10. Work simplification training classes for employees are most effective if the classes are spaced over a reasonable period of time rather than concentrated within a very short period. Follow-up or refresher classes after the original training classes reinforce the learning.
11. Work simplification classes for food service employees are more effective if supplemented by the employees' participation in or contact with actual simplification of work methods on the job.
12. Improved methods adopted by employees as the result of a work simplification training program for food service employees will continue to be used until a better method is developed.
13. Many employees who participate in work simplification training make some usable suggestions for improving work methods and will improve some methods of work determined by them.
14. Suggestions made by employees in regard to simplifying work methods are most often related to changes in the equipment or other physical facilities. Work simplification training provides a basis for employees to evaluate the practicality of such suggestions from the standpoint of effect on other work procedures and economic feasibility.
15. The suggestions which a worker makes for simplifying the methods used in a specific work situation are associated to some extent with the work procedures in which he has participated or which he has observed.

SUMMARY

The purposes of the research were: 1. To select appropriate available visual materials and to develop additional visual materials for training food service employees in work simplification; 2. To plan and try out work simplification training for a group of food service employees using the visual materials selected and developed; 3. To secure information relative to the outcomes of the training program in order to formulate hypotheses regarding the training of employees and specifically in regard to the use of visual materials for teaching work simplification; and 4. To provide a basis for recommending methods of research for similar studies.

A first step toward the accomplishment of these purposes was to define the objectives of work simplification training for employees as: 1. To provide an understanding of work simplification which will make the workers receptive to analysis of their jobs, to methods proposed by management, and to adoption and use of the methods prescribed; 2. To improve management-labor relations and increase the interest of employees in their work; 3. To stimulate employees to make suggestions for improving work methods; 4. To assist the workers to improve those methods of work which are determined by them; 5. To lower costs; and 6. To give impetus to a continuing program of work simplification.

With recognition of these objectives the work simplification generalizations, on which the training program was based, were formulated.

These generalizations, which were stated as guides to work simplification for food service workers are as follows:

A. Tools, equipment, and workplace

1. Use the available equipment that is best for the job
2. Keep tools, equipment, storage and workplace in good working order
3. Have equipment and supplies within easy reach at the place where they are used.

B. Hand and body motions

1. Let both hands do useful work at the same time, when possible
2. Perform work in a rhythmic way - use smooth, continuous, curved motions
3. Use the fewest, shortest, and simplest motions
4. Maintain a comfortable working position, and bring the work you are doing right in front of you if possible

C. Work process or sequence

1. Arrange work areas to eliminate unnecessary walking or reaching
2. Eliminate or combine parts of a job, if possible
3. Plan the order and time of work for best results
4. Standardize procedures to eliminate need for repeated decisions.

A review was made of visual materials to determine those which might be appropriate for use in the training program. Five motion pictures

were selected; only one of the films, however, met all of the criteria which had been set up for selecting the visual materials. A small booklet, which related work simplification to homemakers' tasks, was also selected.

The visual materials developed for use in the classes included colored slides and an illustrated booklet. One group of 19 colored slides depicted the procedure followed to simplify a food service job. The remainder of the 67 slides portrayed specific ways in which the various guides to work simplification could be applied to quantity food production and service. The illustrated booklet was designed to aid in introducing the plan for the work simplification classes, in presenting the guides to work simplification, and in providing continuity from one class to the next.

As a basis for determining the workers' understanding of work simplification, situation tests were developed to be administered to the employees before and after the training program. In these tests work situations were presented, and the employees were asked to make suggestions for simplifying the methods used. Since the workers varied in their ability to read and write, the situations were presented by means of motion pictures, and the suggestions made by the workers for simplifying the methods were made orally. The situations were planned so that there would be possibilities for improving the methods used by application of the guides to work simplification. The subjects of the tests were as follows:

<u>Tests</u>	<u>Subjects</u>
I	Serving soup at a cafeteria counter
II	Making sandwiches
III	Eyeing potatoes
IV	Setting up trays in the floor kitchen of a hospital

The four tests were administered to a group of 30 college students without any training or instruction intervening between the tests. It was believed that the test scores of the student group could be used for determining the relative difficulty of the tests, but as the investigation progressed, the use of the student group as a basis for equating the tests was questioned because of the small number of students and because it was doubtful whether the relative difficulty of the tests was the same for the students and employees.

The work simplification training for food service employees was conducted in the men's residence hall on The Iowa State College campus. Before the program was begun, three conferences were held with the Dietitian and food service supervisors and an introductory meeting was held with the full-time employees.

Following this introductory meeting individual interviews were held with each full-time employee at which time the pre-test, tests I and II, were administered and certain data about each employee were collected. The post-test, tests III and IV, were administered in individual interviews four weeks after the conclusion of the training classes. At these latter interviews the employees were asked to evaluate the work simplification program. Tests I and II were administered as a re-test approx-

imately six months after they had been given as a pre-test.

For three and one half weeks many of the work processes used by the employees were observed and recorded in order to select appropriate illustrations for use in the training classes. Other purposes of these observations and subsequent analyses and improvements were to provide on-the-job examples of how a process could be improved by the application of work simplification generalizations and to determine the employees' reactions to having their work methods studied, the extent to which the employees would make suggestions for improving work methods, and whether they would adopt and use new work methods later proposed.

Seven work simplification classes were conducted for the employees during a period of slightly over three weeks. The visual materials previously selected and developed were used in these classes. It was necessary to repeat each class three times in order to make it possible for 23 of the workers to attend.

Following these classes, during a period of five weeks, there was further study of work methods in the kitchen and dining room. Improved methods were developed and installed for several work processes. In some instances improvements were not effectuated although possibilities for improvements were considered.

There was a variety of outcomes resulting from the training program. Progress was made in improving work methods. Employees who participated in or had direct contact with work process studies gave excellent co-operation when work methods were being analyzed and improved methods

developed. Employees who were asked to adopt new work methods did so, at least during the times observed. It is not known, however, to what extent the excellent cooperation of the workers was the direct result of the training classes and the procedures used during the training program. Support of the program by the management is believed to have been an important influence in assuring the cooperation of the workers. Greater accomplishment could probably have been realized if there had been more active participation by the supervisors in the program. Employees made suggestions for improving work methods both in the classes and during the work process studies. The workers also evidenced an understanding of the viewpoint of management. Of the 23 workers, 18 indicated that they believed the work simplification classes had been beneficial for them.

The conduction of the seven classes provided further evidence. The visual materials used facilitated the presentation of information in the classes, engendered the interest of the employees, and would seem to have aided learning although there was no specific evidence to substantiate this latter point. Even though visual materials directly related to food service work are probably most effective in training food service employees, some motion pictures concerned with aspects of work simplification which were not directly related to food service were used and seemed to be effective. Two of the motion pictures used in the classes were too long to allow for adequate interpretation and discussion within the 30-minute periods. The training would probably have been more ef-

fective if there had been additional class time. Some problems are recognized in the use of certain visual materials when training food service employees; it is believed, however, that these problems can be overcome by organization and planning.

The situation tests developed for evaluating the employees' understanding of work simplification were not entirely satisfactory as instruments of evaluation; however, various analyses made of the test scores gave some indication that the employees' ability to apply work simplification generalizations was greater following the training program. There was not a significant correlation between the test scores and age, experience ratings, and verbalization rankings of the employees; however, there was some evidence to suggest that both age and verbalization rankings may be related to the workers' performance on the situation tests. Further, the evidence was not sufficient to draw any conclusion in regard to the relation between the test scores and educational level or sex of the workers.

Although it was not possible to provide unquestionable evidence that the employees who participated in or had direct contact with work process studies made greater progress toward the objectives for the program, than those who did not, there was some support for this belief.

On the basis of the experiences in this research program recommendations were made regarding research methodology for similar research studies.

Generalizations related to training and specifically to the use of visual materials for training food service employees in work simplifica-

tion were formulated. Those which, on the basis of the present research and the experiences and recommendations reported in the literature, appear to be generally accepted were formulated as assumptions. Fifteen generalizations which need further investigation before acceptance were formulated as hypotheses.

LITERATURE CITED

1. Actual cost of peeled potatoes. College and University Business. 15, no. 5: 48, 50. Nov. 1953.
2. Alford, L. P. and H. Russell Beatty. Principles of industrial management. Rev. ed. N. Y., Ronald Press Co. 1951.
3. Anderson, J. Milo. Committees and graduate students. Methods Improvement Interim Report of the Committee on Methods Improvement. p. 18-21. Chicago, Ill., American Hospital Assoc. May 1954.
4. Brooker, Floyd E. Training films for industry. Final Report on the War Training Program of the Division of Visual Aids for War Training. U. S. Office of Education. Bul. 13. 1946.
5. Chadderdon, Hester, Sara Ann Brown, Catherine Downing, and Kathryn Kendall Kelly. Development of paper-and-pencil tests to evaluate the ability to apply generalizations in home economics. Board for Vocational Education, State of Iowa. Des Moines, Iowa. 1947.
6. Coach, Lester and John R. P. French Jr. Overcoming resistance to change. Human Relations. 1, no. 4: 512-532. 1948.
7. Dale, Edgar. Audio-visual methods in teaching. Rev. ed. N. Y., Dryden Press, Inc. 1954.
8. Dodge, Quindara Oliver. Feeding workers for health and efficiency. Industry. 8, no. 5: 18-22, 40, 42. Feb. 1943.
9. Eppright, Ercel S. Factors influencing food acceptance. J. Am. Dietetic Assoc. 23, no. 7: 579-587. July 1947.
10. Fitzsimmons, Cleo, Eva Goble, and Gertrude Monhaut. Easy ways. Purdue Agricultural Extension Service, Lafayette, Ind. Bul. 391. 1953.
11. Frederick, Earl. Two hospitals employ a methods engineer. Methods Improvement Interim Report of the Committee on Methods Improvement. p. 25-28. Chicago, Ill., American Hospital Assoc. May 1954.
12. Ganong, Warren. The use of an industrial consultant. Methods Improvement Interim Report of the Committee on Methods Improvement. p. 34-38. Chicago, Ill., American Hospital Assoc. May 1954.

13. Gibbs, F. H. An introduction to methods improvement in hospitals. Methods Improvement Interim Report of the Committee on Methods Improvement. p. 5-13. Chicago, Ill., American Hospital Assoc. May 1954.
14. Goldrath, Bert. Camera in the kitchen. Hotel Management. 67, no. 4: 58-59, 136. April 1955.
15. Haas, Kenneth B. and Harry Q. Packer. Preparation and use of audio-visual aids. 3d ed. N. Y., Prentice-Hall. 1955.
16. Hoban, Charles F. Jr. and Edward B. van Ormer. Instructional film research, rapid mass learning, 1918-1950. NAVEXOS P-977. Special Devices Center. U. S. Dept. of the Navy, Office of Naval Research. Port Washington, L. I., N. Y. 1951.
17. Hudson, Wellborn R. An application of management engineering to nonrepetitive work - hospital nursing. Unpublished Ph. D. Thesis. Iowa City, Iowa, State University of Iowa Library. 1954.
18. Hummel, Alta Long. The use of slides as a means of instruction in the operation of the floor-model mixer and single tank door-type dishwasher. Unpublished M. S. Thesis. State College, Pa., Pennsylvania State College Library. 1945.
19. Institutions on parade. Institutions Magazine. 33, no. 3: 212. Sept. 1953.
20. Iowa State College, Visual Instruction Service. 1953-54 Catalog of Audio-Visual Materials. Ames, Iowa. 1954.
21. de Kieffer, Robert and Lee W. Cochran. Manual of audio-visual techniques. N. Y., Prentice-Hall, Inc. 1955.
22. Kinder, James S. Audio-visual materials and techniques. N. Y., American Book Co. 1950.
23. Kirkpatrick, Mary E., Beatrice M. Mountjoy, and Linda C. Albright. Influence of variety on yield of potatoes prepared for cooking. J. Am. Dietetic Assoc. 28, no. 3: 231-234. March 1952.
24. Kleinschmidt, Arthur C. Some applications of engineering valuation-industrial engineering theory to cost reduction in industry. Unpublished Ph. D. Thesis. Ames, Iowa, Iowa State College Library. 1953.
25. Knowles, Malcolm S. Informal adult education. N. Y., Association Press. 1950.

26. Lipscomb, Mary. Application of work simplification to three food service activities. Unpublished M. S. Thesis. Ames, Iowa, Iowa State College Library. 1954.
27. Lorge, Irving. Effective methods in adult education. Report of the Southern Regional Conference Workshop for Agricultural Extension Specialists. 1947. In Knowles, Malcolm S. Informal adult education. p. 16. N Y., Association Press. 1950.
28. Lundberg, Donald E. Personnel management in hotels and restaurants. Dubuque, Iowa, Wm. C. Brown Co. 1955.
29. Macfarlane, Alberta M. What goes into good management. Institutions Magazine. 35, no. 1: 11, 26-29. July 1954.
30. McGehee, William. Training in industry. In Current trends in industrial psychology. p. 84-114. Pittsburgh, University of Pittsburgh Press. 1949.
31. McGehee, William and Dwight H. Livingstone. Training reduces material waste. Personnel Psychology. 5, no. 2: 115-124. Summer 1952.
32. _____ and _____. Persistence of the effect of training employees to reduce waste. Personnel Psychology. 7, no. 1: 33-39. Spring 1954.
33. McKnown, Harry C. and Alvin B. Roberts. Audio-visual aids to instruction. 2d ed. N. Y., McGraw-Hill Book Co., Inc. 1949.
34. Maier, Norman R. F. Principles of human relations, applications to management. N Y. John Wiley and Sons, Inc. 1952.
35. _____. Psychology in industry. Boston, Houghton Mifflin Co. 1946.
36. _____. Psychology in industry, a psychological approach to industrial problems. Boston, Houghton Mifflin Co. 1955.
37. Maytag Company. The employees' idea plan. Newton, Iowa. 1955. Mimeographed.
38. _____. Procedures for employees' idea plan. Newton, Iowa. 1954. Mimeographed.
39. _____. Supervisors work simplification and employees' idea plan. Newton, Iowa. 1954.
40. _____. Work simplification for supervisors. Newton, Iowa. 1955. Mimeographed.

41. Mitchell, Margaret L. Management and organization in quantity food production. J. Am. Dietetic Assoc. 37, no. 7: 680-684. July 1955.
42. Mogensen, A. H. How to set up a program for motion economy. Factory Management and Maintenance. 93, no. 11: S133-S148. Nov. 1935.
43. Morgan, Howard K. Industrial training and testing. N. Y., McGraw-Hill Book Co., Inc. 1945.
44. Mundel, Marvin E. Motion and time study, principles and practice. N. Y. Prentice-Hall, Inc. 1950.
45. Murphy, Henry J. Special training for assistant directors. Methods Improvement Interim Report of the Committee on Methods Improvement. p. 29-33. Chicago, Ill., American Hospital Assoc. May 1954.
46. National Industrial Conference Board. The economic almanac 1956. N. Y., Thomas Y. Crowell Co. 1956.
47. _____. Personnel activities in American business. Rev. ed. Studies in Personnel Policy. No. 86. 1947.
48. National Restaurant Association. Facts about the restaurant industry. Chicago, Ill. 1956.
49. North Dakota Agricultural Experiment Station. Consumer acceptance of and preference for potatoes. North Central Regional Publication 24. N. D. Agricultural Experiment Station. Bul. 374. 1952.
50. Odiorne, George S. Joint training in time study. Personnel. 30, no. 3: 203-205. Nov. 1953. (Original not available for examination; abstracted in Personnel J. 32, no. 10: 394. March 1954.)
51. O'Herron, Rosalie Ellis. Development of a training program for student employees in a college food service. Unpublished M. S. Thesis. Ames, Iowa, Iowa State College Library. 1953.
52. Parker, William E. and Robert W. Kleemeier. Human relations in supervision. N. Y., McGraw-Hill Book Co., Inc. 1951.
53. Pfeiffer, William B. Do it with pictures. Hotel Management. 67: 66-67, 128. March 1955.
54. Pine, Leon G. Effectiveness of filmstrips in presenting occupational information. Unpublished M. S. Thesis. Ames, Iowa, Iowa State College Library. 1941.

55. Planned for tomorrow. Institutions Magazine. 36, no. 6: 36-37. June 1955.
56. Planty, Earl G., William S. McCord, and Carlos A. Efferson. Training employees and managers for production and teamwork. N. Y., Ronald Press. 1948.
57. Raymond, K. Louise Johnson. Development of audio-visual aids for teaching quantity food production and service. Unpublished M. S. Thesis. Ithaca, N. Y., Cornell University Library. 1948.
58. Remmers, H. H., and N. L. Gage. Educational measurement and evaluation. N. Y., Harper. 1955.
59. Rothlisberger, F. J. and William J. Dickson. Management and the worker. Cambridge, Mass., Harvard University Press. 1949.
60. Ryan, T. A. Work and effort, the psychology of production. N. Y., Ronald Press. 1947.
61. Sears, Roebuck and Co. Why work simplification clicks -- and why it fails. Factory Management and Maintenance. 112, no. 11: 122-124. Nov. 1954.
62. Small, Mary L. Increasing food service efficiency and morale through work simplification. College and University Business. 12, no. 6: 30-33. June 1952.
63. "Spec" objective achieved. Institutions Magazine. 33, no. 2: 28-29. Aug. 1953.
64. U. S. Dept. of Commerce, Office of Business Economics. Survey of Current Business. 35, no. 7. July 1955.
65. U. S. Dept. of the Navy. A bibliography of production, utilization and research on instructional films. Technical Report - SPECDEVCON 269-7-40. Office of Naval Research. Special Devices Center. Port Washington, L. I., N. Y. 1953.
66. U. S. Office of Education. Use of training aids in the armed services. A Report of the Committee on Military Training Aids and Instructional Materials. Office of Education Bul. 9. 1945.
67. U. S. Public Health Service. Instructor's guide to be used for training food service personnel sanitary food service. Public Health Service, Division of Sanitation, Milk and Food Branch. Pub. 90. Washington, D. C. 1952.

68. Vander Meer, A. W. The economy of time in industrial training: an experimental study of the use of sound films in the training of engine lathe operators. J. of Educational Psychology. 36, no. 2: 65-90. Feb. 1945.
69. Watson, Jeanne. Scientists and sweetbreads. Adult Leadership. 2, no. 9: 24-26. Feb. 1954.
70. Weaver, G. G. and E. W. Bollinger. Visual aids, their construction and use. N. Y., D. Van Nostrand Co., Inc. 1949.
71. Williamson, Maude and Mary S. Lyle. Homemaking education for adults. N. Y. Appleton-Century-Crofts, Inc. 1949.
72. Wittich, Walter Arno and Charles Francis Schuller. Audio-visual materials, their nature and use. N. Y., Harper. 1953.
73. Wright, Marion. A hospital study. Methods Improvement Interim Report of the Committee on Methods Improvement. p. 14-17. Chicago, Ill., American Hospital Assoc. May 1954.
74. Wright, Wayne K. Sound motion pictures versus reading material in teaching occupational information. Unpublished M. S. Thesis. Ames, Iowa, Iowa State College Library. 1941.
75. Yaw, Ronald D. Using staff talents. Methods Improvement Interim Report of the Committee on Methods Improvement. p. 22-24. Chicago, Ill., American Hospital Assoc. May 1954.

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APPENDICES

APPENDIX A

Description of Motion Pictures

Name of film: Improving the Job

Sponsored by: U. S. Office of Education

Secured from: Iowa State College, Visual Instruction Service (20)

(16 mm., black and white, sound, 9 min.) A supervisor in a factory asks one of his workmen for suggestions for preventing waste. The workman explains the situation to members of his family at home, and methods of improving the job so as to prevent waste are considered.

Name of film: Now I'm in Business

Sponsored by: Blakeslee and Co.

Secured from: Ideal Pictures, 1402 Locust Street, Kansas City 6, Missouri

(16 mm., color, sound, 26 min.) The advantages of having modern, efficient equipment for large quantity food production are exemplified. In an attempt to help one restaurant owner improve his operation, the story of how another restaurant owner modernized his facilities is presented. A variety of institution type equipment in many different kitchens is shown.

Name of film: Motion Study Principles

Sponsored by: University of Iowa

Secured from: The Iowa State College, Visual Instruction Service (20)

(16 mm., black and white, sound, 28 min.) Eleven principles of motion economy are presented with the following three applications to illustrate the principles: bolt and washer assembly, refrigerator doorknob assembly, and folding x-ray film packing papers.

Name of film: Skill Counts at the Sandwich Counter

Sponsored by: Wheat Flour Institute

Secured from: Ideal Pictures, 58 E. South Water Street, Chicago 1, Illinois

(16 mm., color, sound, 10 min.) Recommended procedures for making sandwiches to order and in quantity are given. The importance of having sandwich ingredients arranged close to the work area is emphasized. Motions and tools used are shown. Several examples are given of attractive sandwich plate arrangements.

Name of film: Damp Dusting

Sponsored by: Bell Telephone Co.

Secured from: Bell Telephone Co.

(16 mm., color, sound, 19 min.) Recommended ways of dusting are shown. Emphasis is placed on the importance of correct tools, methods, and planning. The methods that used to be followed by a janitor are compared to the more efficient cleaning methods used today. The setting of the film is in a telephone building.

Name of film: Damp Sweeping

Sponsored by: Bell Telephone Co.

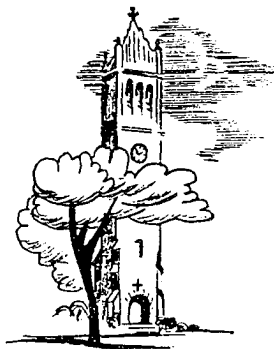
Secured from: Bell Telephone Co.

(16 mm., black and white, sound, 5 min.) A method of damp sweeping was demonstrated in which a damp cloth was placed over the head of the sweeping tool. Different types of sweeping strokes were shown.

A WORK
SIMPLIFICATION
PROGRAM

in FRILEY HALL
FOOD SERVICE
DEPARTMENT

IOWA
STATE
COLLEGE



Illustrated Training Booklet

WORK SIMPLIFICATION

is improving methods of

doing work - - - - -

finding a better way

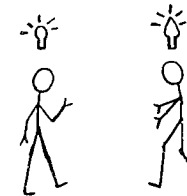
If you have a dollar and I have a dollar ---
and we exchange



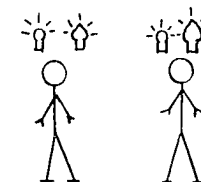
We still each have just one dollar



BUT --- if you have an idea and I have an idea ---
and we exchange



We'll each have two ideas



WORK SIMPLIFICATION PROGRAM

Conferences

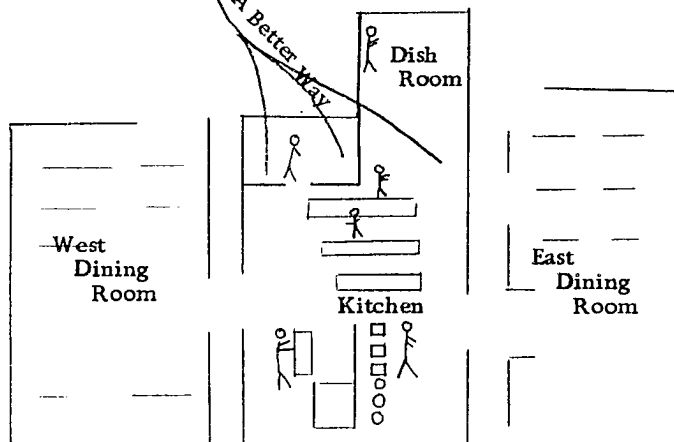


Suggestions

Ideas



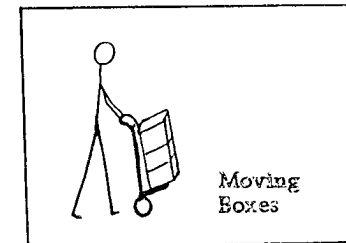
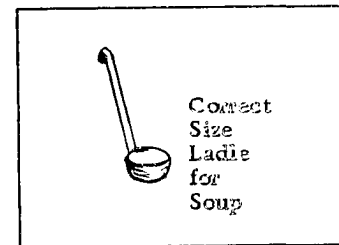
Results



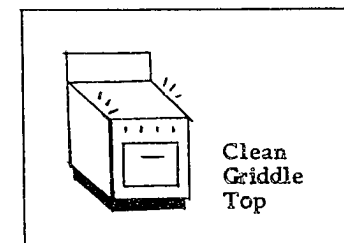
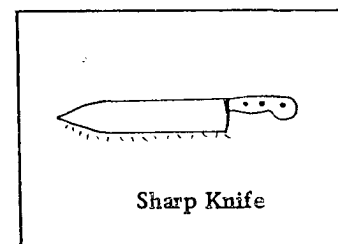
GUIDES TO WORK SIMPLIFICATION with -----

Tools, equipment and work place

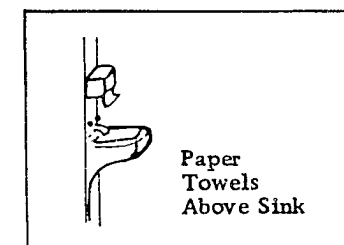
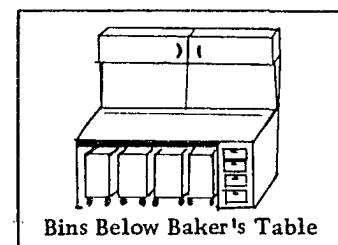
Use the available equipment that is best for the job



Keep tools, equipment, storage and work place in good working order



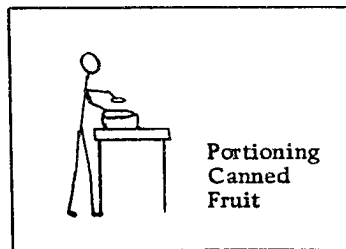
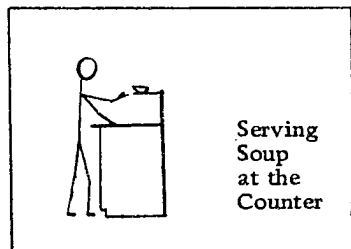
Have equipment and supplies within easy reach at the place where they are used



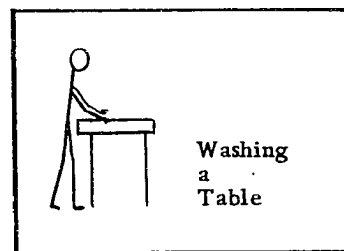
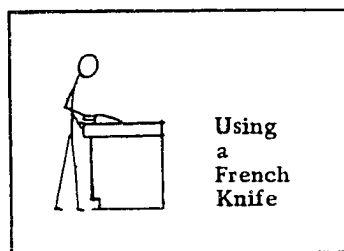
GUIDES TO WORK SIMPLIFICATION with ----

Hand and Body Motions

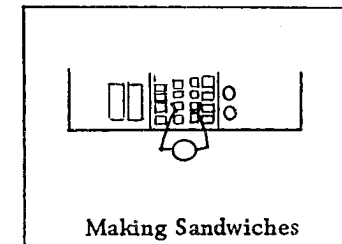
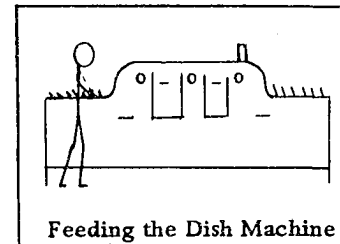
Let both hands do useful work at the same time, when possible



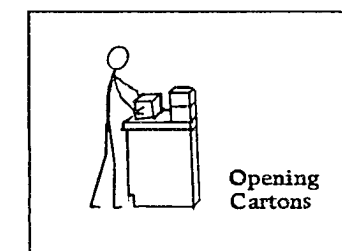
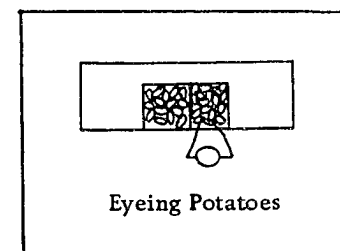
Perform work in a rhythmic way - use smooth continuous curved motions



Use the fewest, shortest, and simplest motions



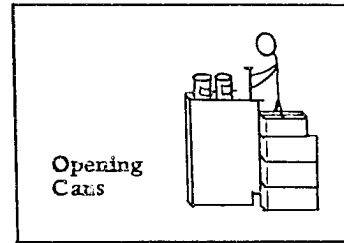
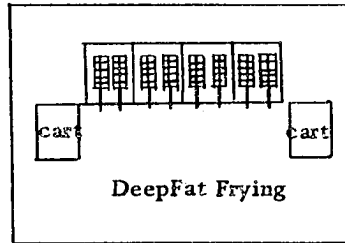
Maintain a comfortable working position and bring the work you are doing right in front of you, if possible



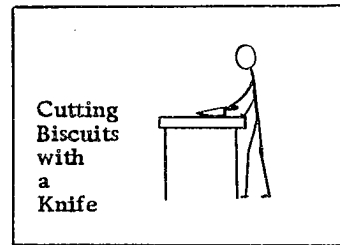
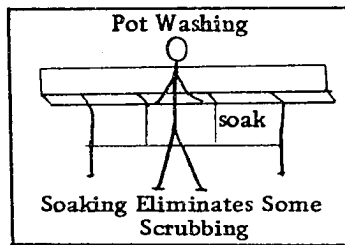
GUIDES TO WORK SIMPLIFICATION with ----

Work Process or Sequence

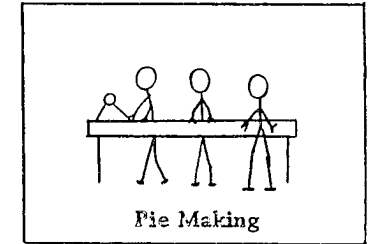
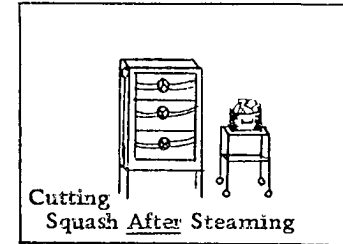
Arrange work areas to eliminate unnecessary walking or reaching



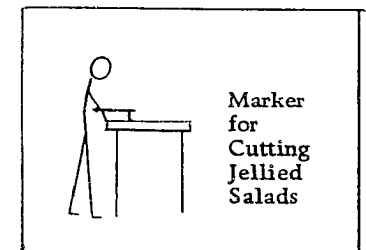
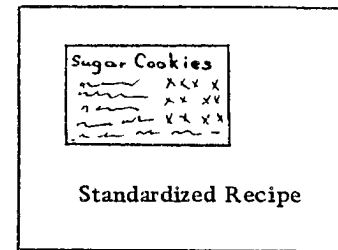
Eliminate or combine parts of a job, if possible



Plan the order and time of work for best results



Standardize procedures to eliminate need for repeated decisions



- IDEAS -

- IDEAS -

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RATING SCALE

Name of worker _____ Name of job _____ Ini

Please check your estimate of the relative skill needed to perform satisfactorily the job. Considerable skill _____, Average skill _____, Little skill _____.

In your opinion is the worker capable of performing a job that requires more skill? Yes _____, No _____.

Please check one of the five places on each of the rating scales below that gives your best estimate of the characteristic being rated.

Disposition, and cooperation with supervisors and co-workers	Always pleasant, always cooperates willingly	Usually pleasant, usually cooperates	Disagreeable, uncooperative in many situations
Quantity of work	Consistently turns out work at a fast rate	Does some jobs quickly, others slowly	Does all work at a slow rate
Quality of work	Always satisfactory	Usually satisfactory	Often unsatisfactory
Dependability	Can be depended on to get work done	Conscientious, but needs supervision	Wastes time, needs close supervision
Ingenuity	Meets emergencies, makes good suggestions for improving work	Usually can figure out how to meet emergencies	Does not see how to meet emergencies
Job satisfaction	Enjoys work, takes pride in work	Matter-of-fact, accepts work without comment	Sometimes unhappy in work and not interested
Effort (physical and/or mental in performing work done)	Works with ease	Expend normal effort	Expend excessive effort

Please give on the back of sheet additional information about this worker that would be desirable in order to work effectively with her (or him).

Rating

RATING SCALE

Name of job _____ Initials of supervisor _____
 Active skill needed to perform satisfactorily the job in which worker is employed.
 Little skill _____.
 Performing a job that requires more skill? Yes ____, No ____
 On each of the rating scales below that gives your best estimate of the worker for

	Usually pleasant, usually cooperates	Disagreeable, uncooperative in many situations	I have had too little opportunity to observe this characteristic
_____	_____	_____	_____
_____	Does some jobs quickly, others slowly	Does all work at a slow rate	_____
_____	_____	_____	_____
_____	Usually satisfactory	Often unsatisfactory	_____
_____	_____	_____	_____
_____	Conscientious, but needs supervision	Wastes time, needs close supervision	_____
_____	_____	_____	_____
is _____	Usually can figure out how to meet emergencies	Does not see how to meet emergencies	_____
_____	_____	_____	_____
_____	Matter-of-fact, accepts work without comment	Sometimes unhappy in work and not interested	_____
_____	_____	_____	_____
_____	Expend normal effort	Expend excessive effort	_____
_____	_____	_____	_____

Additional information about this worker that would be desirable for me to know in (im).

Personal Data

Name _____ Sex _____ Research No. _____
Birth place _____ Birth date _____
Physical defects _____
Relatives at Iowa State College _____
Previous employment at Iowa State College _____

Personal Data Form

Name _____

Present job _____ Time in present job _____

Hours of work _____ Days off _____

Description of duties in present job _____

Work Record

Name of job	Length of time	Description of work
1. _____	_____	_____
2. _____	_____	_____
3. _____	_____	_____
4. _____	_____	_____
5. _____	_____	_____
6. _____	_____	_____
7. _____	_____	_____
8. _____	_____	_____
Total years of work	_____	_____
Education completed	_____	_____

Personal Data Form

3. _____

4. _____

5. _____

6. _____

7. _____

8. _____

Total years of work _____

Education completed _____

Estimate of health; Poor _____ Average _____ Good _____

Type of work preferred _____

Comments:

Condensation of the Information Presented in the Introductory Meeting

Research is now being done in other places than the laboratory. I have received permission to conduct a research project in this food service unit. The first three to four weeks I shall be observing and getting information in the kitchen and shall study one or two of the work processes in each unit of the kitchen. This will be followed by a series of seven meetings that you will be given time to attend in which motion pictures and colored slides will be used. (Some description was given of the preparation of these materials.) We shall attempt to make application of the ideas in the films and slides to certain work in the kitchen. After these meetings I shall have another period of observation in the kitchen. By making comparisons I hope to see how effective the meetings were. In addition I shall need to have short conferences with each of you to get your reactions to some motion pictures. It is hoped that the research project will be enjoyable to you and will be beneficial to this food service unit here and other food services. The success of the project is greatly dependent on your cooperation.

Introductions to Situation Tests

Test I - Serving soup at a cafeteria counter

Before first showing of motion picture

This is a motion picture of a woman serving soup at a cafeteria counter. After you have seen it will you tell me all the possible ways you can think of for making this job of serving soup easier. Just suppose you could make any changes you wanted to - what would you suggest? The picture will last about a minute and a half. Then you tell me any suggestions you have. Then I'll run the same picture again to see if you have any other suggestions.

*After first showing of motion picture

Now supposing you could make any changes you wanted to, what suggestions do you have for making this job easier.

*Before second showing of motion picture

Now let's look at the same film again. Perhaps you'll see something that you didn't see before.

Test II - Making sandwiches

This next picture is of three women preparing sandwiches in quantity. The ingredients they are using to make the sandwiches are bread, mayonnaise, sliced meat, and lettuce. After the sandwiches are made they are cut and wrapped. The picture will last about three minutes. After you have seen it will you tell me all the possible ways you can think of for making this job of preparing sandwiches in quantity easier. Just as before, I'll run the picture a second time.

*Repeated for all four tests.

Test III - Eyeing potatoes

The first picture is of a woman eyeing potatoes that have been run through a potato peeler. After the potatoes are eyed, the worker drops them in the next sink. When there are enough potatoes eyed, she places them in a steamer basket. Then she carries the steamer basket to the steamer. The picture will last about a minute and a half. After you have seen it will you tell me all the possible ways you can think of for making this job of eyeing potatoes easier. Then I'll run the same picture again to see if you have any other suggestions.

Test IV - Setting up trays in the floor kitchen of a hospital

This next picture is of a woman assembling hospital trays in the floor kitchen of a hospital (the term floor kitchen was explained). First the worker looks at her list on the table to see the number of trays needed. Then she gets the trays and places them on a table. Then she takes the tray covers and places them; then the napkins and the knives, forks, and spoons. Finally, she places the trays on the tray cart. This picture will last about three minutes. After you have seen it will you tell me all the possible ways you can think of for making this job of assembling trays easier. Then I'll run the same picture again to see if you have any other suggestions.

Condensation of Additional Information Presented in Class I

Work simplification is improving methods of doing work -- finding a better way. Work simplification is a beneficial subject for anyone to consider because you can apply the ideas in your work on the job, cooking or keeping house at home, or if you work in a factory or on a farm. Work simplification programs have been carried on in all kinds of work, and it has been found that if any job is studied carefully with a real questioning attitude a better way can be found to do it. The objective in work simplification is to produce the desired results in the easiest, most economical, and safest way. The desired results will vary depending on the job. If the job is to prepare a food product, the desired results are a product of good quality prepared in a sanitary way. (Other examples were given.) The best way of doing a job may be different in different situations, and the best known way of doing a job in a given situation may change with a change in conditions. (Examples were given.) It is good for you to learn about work simplification. You are the one who is closest to a job, and you may have the best ideas about better methods.

These group meetings are planned for an exchange of ideas. We'll pass the ideas on to the supervisors and work toward finding a better way to do some of the jobs in the kitchen and dining rooms.

In summary this is what we hope to accomplish in these meetings:

1. That we'll learn some of the guides to work simplification.
2. That we'll come up with some ideas as to how to simplify a few of the jobs in the food service department. (I'll take responsibility for carrying this project through, but I want your suggestions.)
3. That from this program you'll find ways of simplifying other things you do.

APPENDIX B

[illegible]

[illegible]

OPERATION SHEET No. III

OPERATION Slicing Peeled Oranges,				Date 3/27/55	
Original Method				Operation No.	
Part Name				Sheet No. Of	
Operator's Name and No. Salad Employee No. 2				Made by: McKinley	
LEFT HAND				RIGHT HAND	
to pan A			D 3	O 3	hold knife
grasp 2 oranges			D 3	O 3	hold knife
to board			D 3	O 3	hold knife
release 2 oranges			D 3	O 3	hold knife
to pan A			D 2	O 2	hold knife
grasp 3 oranges			D 2	O 2	hold knife
to board			D 2	O 2	hold knife
release 3 oranges			D 2	O 2	hold knife
grasp orange			D 12	O 12	hold knife
to cutting position			D 12	O 12	hold knife
hold orange			12	12	slice 4 times
grasp orange slices			D 12	O 12	hold knife
toss to pan B			D 12	O 12	hold knife
Summary for 12 oranges			D	O	Sample time for 12
Left hand		Right hand	D	O	oranges 1.62 minutes
46	0	12	D	O	
22	→	0	D	O	
12	D	68	D	O	
			D	O	

[illegible]

OPERATION SHEET No. V



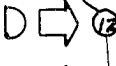
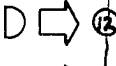



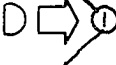


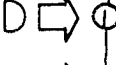




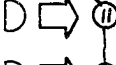


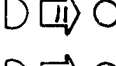

OPERATION Coring and Cutting Tomatoes		Date 4/1/55	
for Tossed Salad, Original Method		Operation No.	
Part Name		Sheet No. 1 Of	
Operator's Name and No. Salad Employee No. 2		Made by: McKinley	

	LEFT HAND			RIGHT HAND
	grasp tomato from pan A	D → 12	12 → D	Release tomato
	to cutting position	D → 12	12 → D	to cutting position
	hold tomato	D → 12	12 → D	cut out stem end
	regrasp tomato	D → 12	12 → D	hold paring knife
	hold tomato	D → 12	12 → D	cut other end
	transfer cored tomato to right hand	D → 12	12 → D	receive cored tomato
	reach for tomato	D → 12	12 → D	to board with tomato
	grasp tomato	D → 6	6 → D	grasp French knife
	to cutting position	D → 6	6 → D	to cutting position
	hold tomato together as sliced	D → 6	6 → D	slice tomato 2 or 3 times
	turn tomato	D → 6	6 → D	hold knife
	rotate tomato	D → 6	6 → D	cut in small pieces (6 to 10 cuts)
	push tomato pieces on blade of knife	D → 6	6 → D	push knife blade under tomato pieces
	hold tomato pieces on blade	D → 6	6 → D	transfer tomato pieces on blade to pan B - drop
	to tomato	D → 6	6 → D	to cutting position
	grasp tomato	D → 6	6 → D	hold knife
	to cutting position	D → 6	6 → D	hold knife
	hold tomato together as sliced	D → 6	6 → D	slice tomato 2 or 3 times
	turn tomato	D → 6	6 → D	hold knife
	rotate tomato	D → 6	6 → D	cut in small pieces (6 to 10 cuts)

[illegible]

OPERATION SHEET No. VI

OPERATION <u>Coring and Cutting Tomatoes</u>		Date <u>5/20/55</u>	
for Tossed Salad, Improved Method		Operation No.	
Part Name		Sheet No. <u>1</u> Of	
Operator's Name and No. <u>Salad Employee No. 2</u>		Made by: <u>McKinley</u>	

	LEFT HAND		RIGHT HAND
	grasp tomato from pan 		release tomato
	to cutting position 		to cutting position
	hold tomato 		cut out stem end
	regrasp tomato 		hold paring knife
	hold tomato 		cut other end
	transfer cored tomato to right hand 		receive cored tomato
	reach for tomato 		to board with tomato
	grasp tomato 		grasp French knife
	to cutting position 		to cutting position
	hold tomato together as sliced 		slice tomato 2 or 3 times
	turn tomato 		hold knife
	rotate tomato 		cut in small pieces (6 to 8 cuts)
	to tomato 		scrape tomato pieces off
	grasp tomato 		to cutting position
	to cutting position 		hold knife
	hold tomato together as sliced 		slice tomato 2 or 3 times
	turn tomato 		hold knife
	rotate tomato 		cut in small pieces (6 to 8 cuts)
	to tomato 		scrape tomato pieces off
			

[illegible]

OPERATION SHEET No. VII

OPERATION Dicing One Cooked Potato			Date 4/8/55	
for Hashed Brown Potatoes, Original Method			Operation No.	
Part Name			Sheet No. Of	
Operator's Name and No. Employee No. 1			Made by: McKinley	

LEFT HAND				RIGHT HAND
grasp potato	D → ○	○ → D		hold knife
to cutting position	D → ○	○ → D		hold knife
hold potato	2 → ○	2 → D		cut lengthwise*
hold potato	4 → ○	4 → D		cut across**
to potato	D → ○	○ → D		hold knife
	D → ○	○ → D		
Summary	D → ○	○ → D		
Left hand	D → ○	○ → D		
Right hand	D → ○	○ → D		
1 ○ 6	D → ○	○ → D		
2 → 0	D → ○	○ → D		
6 0 3	D → ○	○ → D		
	D → ○	○ → D		
* Usually two lengthwise	D → ○	○ → D	**	Cut across was made
cuts, sometimes 3 or	D → ○	○ → D		against the thumb
5. Cut was made down	D → ○	○ → D		or side of hand, the
into the palm of the	D → ○	○ → D		number of cuts
hand	D → ○	○ → D		varied depending on
	D → ○	○ → D		size of potato
	D → ○	○ → D		
	D → ○	○ → D		

[illegible]

[illegible]

[illegible]

APPENDIX C

Table 15. Test scores of students

Student's number	Test I	Test II	Test III	Test IV
Group A				
1	19	28	13	20
2	20	27	17	20
3	8	17	12	14
4	19	20	22	24
5	17	21	16	15
6	16	21	16	24
7	13	17	8	15
8	16	12	14	14
9	17	15	11	13
10	15	28	19	19
11	16	18	11	14
12	11	25	17	16
13	17	21	15	20
14	18	17	12	18
15	18	17	12	12
Group B				
16	21	22	16	23
17	15	14	18	14
18	17	13	13	9
19	10	19	17	16
20	7	15	16	12
21	11	14	11	18
22	8	13	16	30
23	17	22	20	22
24	17	20	16	15
25	12	16	11	17
26	12	19	15	22
27	18	27	13	10
28	17	18	18	16
29	10	17	17	12
30	13	15	16	21
Mean	14.83	18.93	14.93	17.17

Table 16. Test scores of employees

Employee's number	Pre-test		Post-test		Re-test	
	Test I	Test II	Test III	Test IV	Test I	Test II
1 *	6	20	16	13	14	21
2 *	4	7	16	9	13	9
3 *	8	5	12	4	13	9
4 M	4	5	4	6	15	8
5 *	10	9	16	16	14	34
6	6	14	6	10	16	19
7 *	10	13	12	12	10	13
8 *	4	23	18	22	16	21
9	17	16	8	8	19	28
10 *	2	4	10	2	10	9
11 M	4	10	6	9	15	13
12 M	3	4	9	11	17	11
13 M	6	11	6	4	8	14
14 *	19	23	16	10	17	21
15 M	2	2	12	9	13	5
16	13	15	12	9	12	11
17 *	6	11	15	17	17	19
18 *	15	20	11	16	11	27
19 *	6	13	16	10	15	17
20 M	5	9	10	7	7	17
21 M	11	7	8	4	12	7
22 *	5	17	10	12	10	16
23 *	17	26	24	19	19	34
Mean	7.96	12.35	11.87	10.39	13.61	16.65
24 M	12	30	14	24	18	30
25	12	13	18	13	13	8
26	8	16	-	-	8	13

M Male worker

* Employees who participated in or had direct contact with work process studies

Table 17. Differences between total scores for tests I and II and total scores for tests III and IV for students and employees

Student's number	Differences	Employee's number	Differences
1	-14	1	3
2	-10	2	14
3	1	3	3
4	7	4	1
5	- 7	5	13
6	3	6	- 4
7	- 7	7	1
8	0	8	13
9	- 8	9	-17
10	- 5	10	6
11	- 9	11	1
12	- 3	12	13
13	- 3	13	- 7
14	- 5	14	-16
15	-11	15	17
16	- 4	16	- 7
17	3	17	15
18	- 8	18	- 8
19	4	19	7
20	6	20	3
21	4	21	- 6
22	25	22	0
23	3	23	0
24	- 6		
25	0		
26	6		
27	-22		
28	- 1		
29	2		
30	9		
Mean	- 1.67		1.96
Ex ²	2136.67		2002.96
s ²	73.68		91.04

$$s^2 = \frac{4139.63}{51} = 81.17 \quad s_{\bar{x}} = \frac{\sqrt{81.17(23+30)}}{(23)(30)} = 2.50 \quad t = \frac{3.63}{2.50} = 1.45$$

Table 18. Age, experience rating, verbalization ranking, and education rating of employees

Employee's number	Age	Experience rating	Verbalization ranking			Education rating
			Judge 1	Judge 2	Judge 3	
1	53	12	10	20	20	2
2	53	12	15	14	15	2
3	65	19	23	12	23	3
4 M	41	9	19	25	11	1
5	62	13	8	3	16	2
6	70	13	2	2	1	1
7	65	13	18	19	25	1
8	38	10	1	6	2	1
9	61	22	11	17	14	2
10	60	11	22	13	6	2
11 M	63	15	14	4	9	1
12 M	61	14	21	21	10	1
13 M	64	15	5	8	7	2
14	61	12	4	10	5	2
15 M	71	19	12	9	8	1
16	67	15	17	22	24	3
17	50	15	24	15	19	1
18	53	14	7	5	4	1
19	49	17	3	1	3	2
20 M	66	12	13	11	18	1
21 M	70	12	20	23	17	1
22	21	1	25	24	21	1
23	51	23	16	16	22	2
24 M	41	15	9	18	12	3
25	66	10	6	7	13	1
26						

M Male

Analysis of Variance A

Scores for Student Groups A and B

Source of variation	Degrees of freedom	Mean square
Groups	1	56.06
Students per group	28	57.42
Order	1	141.06
Tests	1	41.68
Remainder	28	33.12

$$F_{\text{Groups}} = \frac{56.06}{57.42} = 0.98$$

$$F_{\text{Order}} = \frac{141.06}{33.12} = 4.26^*$$

$$F_{\text{Tests}} = \frac{41.68}{33.12} = 1.26$$

*Significant at $P = .05$

Analysis of Variance B

Scores for Employees, Pre-test and Post-test

Source of variation	Degrees of freedom	Mean square
Employees	22	74.81
Individual tests	3	89.63
Pre-test and post-test	1	48.79
Employees and individual tests	66	15.25

$$F_{\text{Pre-test and post-test}} = \frac{48.79}{15.25} = 3.20$$

Analysis of Variance C

Scores for Employees, Pre-test and Re-test

Source of variation	Degrees of freedom	Mean square
Employees	22	91.70
Individual tests	3	299.43
Pre-test and re-test	1	570.01
Employees and individual tests	66	19.63

$$F_{\text{Pre-test and re-test}} = \frac{570.01}{19.63} = 29.04^{**}$$

******Significant at P = .01

Analysis of Variance D

Scores for Employees, Post-test and Re-test

Source of variation	Degrees of freedom	Mean square
Employees	22	74.61
Individual tests	3	166.55
Post-test and re-test	1	368.00
Employees and individual tests	66	17.26

$$F_{\text{Post-test and re-test}} = \frac{368.00}{17.26} = 21.32^{**}$$

******Significant at P = .01